FEBRUARY 1959—SIXTY-FIFTH YEAR

Machinery

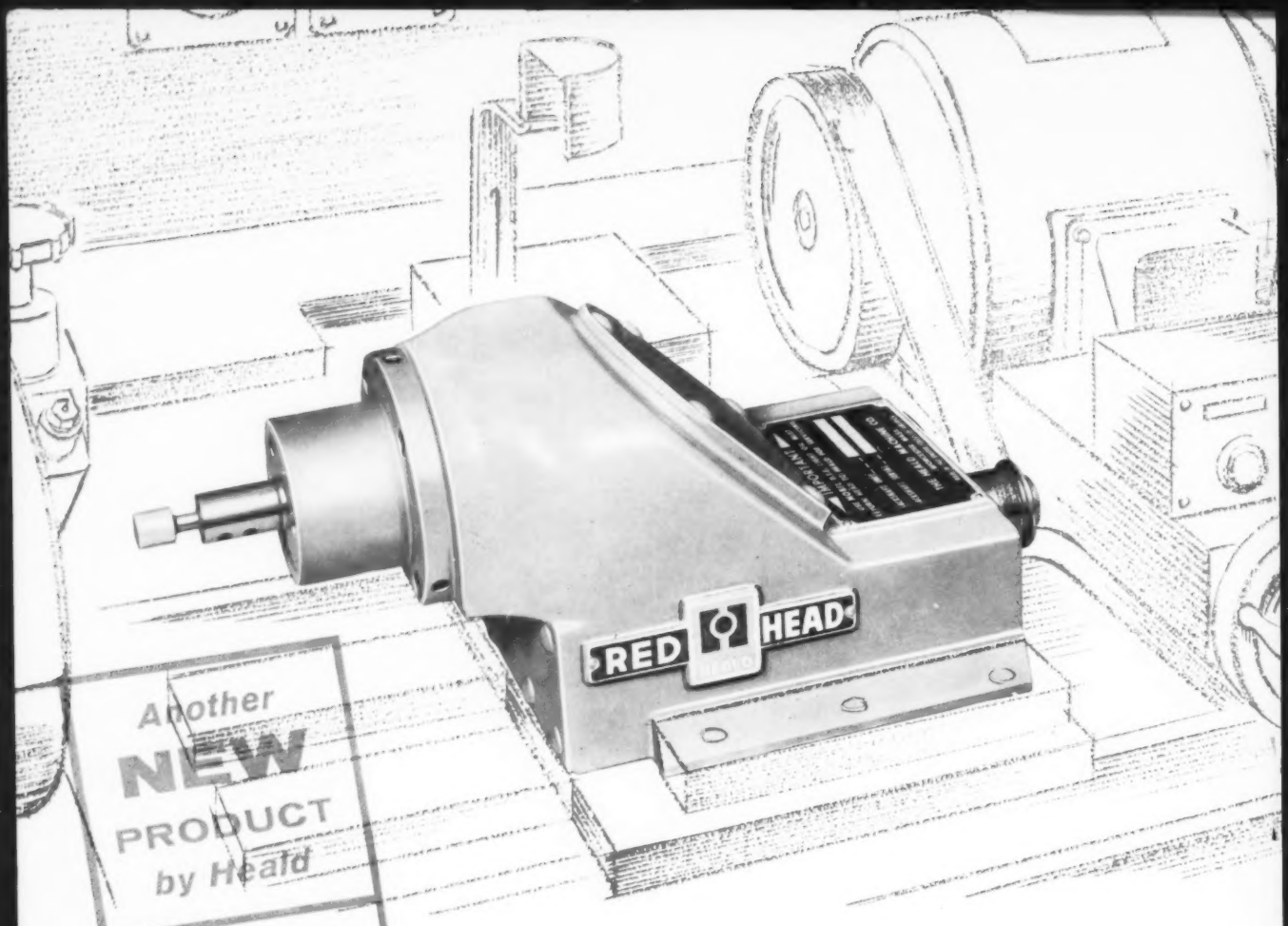
1000 strokes a minute!

Now in daily operation at the Truarc Retaining Rings Division of Waldes Kohinoor, Inc., of Long Island City, New York, this new Bliss High Production Press is running at the blurring speed of 1000 strokes a minute, hour after hour, day after day. First of its kind, this completely new press has a revolutionary counterbalancing system and massive, close tolerance construction that virtually eliminate vibration, even at this phenomenal speed. Could a press like this cut your parts cost...add to your profit picture? We'll be glad to give you the facts.

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

BLISS is more than a name—it's a guarantee



Another NEW PRODUCT by Heald

☐ File for Reference
☑ Send for Bulletin

Now–for the first time–

a HI-SPEED BELT-DRIVEN WHEELHEAD

for speeds to 100,000 rpm

THE NEW Heald Red Head Hi-Speed belt-driven wheelhead offers a practical, *low-cost solution* to the problem of getting proper wheel speeds for small hole work where high frequency generating equipment is not available. It provides speeds from 45,000 to 100,000 rpm with simple belt drive from a standard electric motor!

The basic wheelhead consists of a jackshaft and body unit and a spindle cartridge. Two easily interchangeable spindle cartridges are available — one for speeds of 45,000, 52,000 and 60,000 rpm; the other for 70,000, 85,000 and 100,000 rpm. The three speeds for each spindle cartridge are obtained simply by changing the drive pulley on the rear end of the jackshaft.

Built to the highest standards of accuracy and precision, this latest addition to the Heald Red Head line opens up a new area of internal grinding operation in the small hole class hitherto impossible without special equipment. Ask your Heald representative for complete information. Or send for a copy of Bulletin 6-3.

HEALD®

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

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Machinery

FEBRUARY 1959 **VOL. 65 No. 6**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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WHY is chaser hardening important to your threads?

When cutting your threads—long tool life, maximum accuracy, and trouble-free operation can only be assured by proper chaser hardening.

Proper chaser-hardening technique is an important intangible offered you by LANDIS Threading Specialists. For example, LANDIS Tangential Chasers are often given special hardening treatment when workpiece design or material specifications so indicate. Just as with the blacksmith of years gone by, so chaser hardening today is an art. The ability to determine and apply the proper chaser-hardening technique is the result of more than 50 years experience in a single field—THREADING.

Yet—chaser hardening is but one benefit of the extensive technical knowledge and practical experience accumulated through years of specialization. Recommendation on unusual tooling set-ups, automation, new methods, the most efficient type of threading equipment are a few of the many ways in which LANDIS Threading Specialists may be of help.

Whatever your need for generating threads —Cutting, Rolling, Grinding, or Tapping— LANDIS Threading Equipment will accomplish it most efficiently and economically.

When asking about threading information please send specifications.

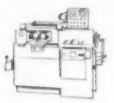
Threading Machines

LANDIS *Machine* COMPANY

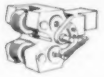
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

WAYNESBORO, PENNSYLVANIA

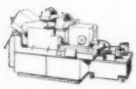
Die Heads—
Rotary & Stationary



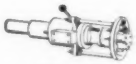
Thread Rolling Machines



Thread Rolling Tools

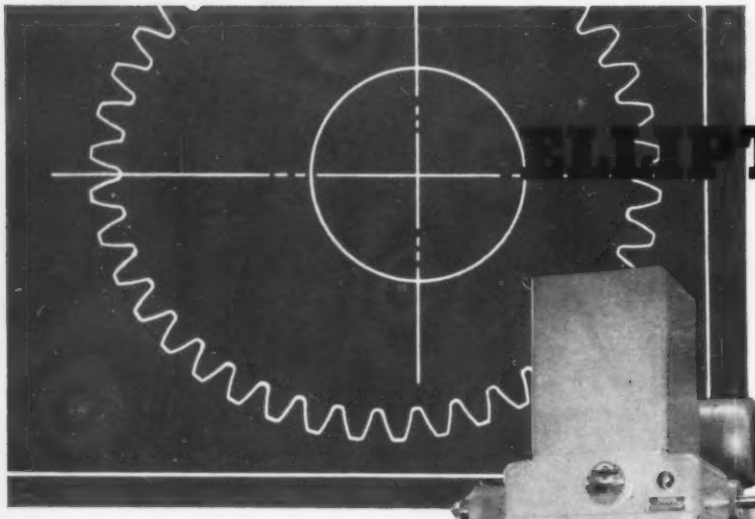


Centerless Thread
Grinding Machines



Taps—Collapsible
& Solid Adjustable

535C



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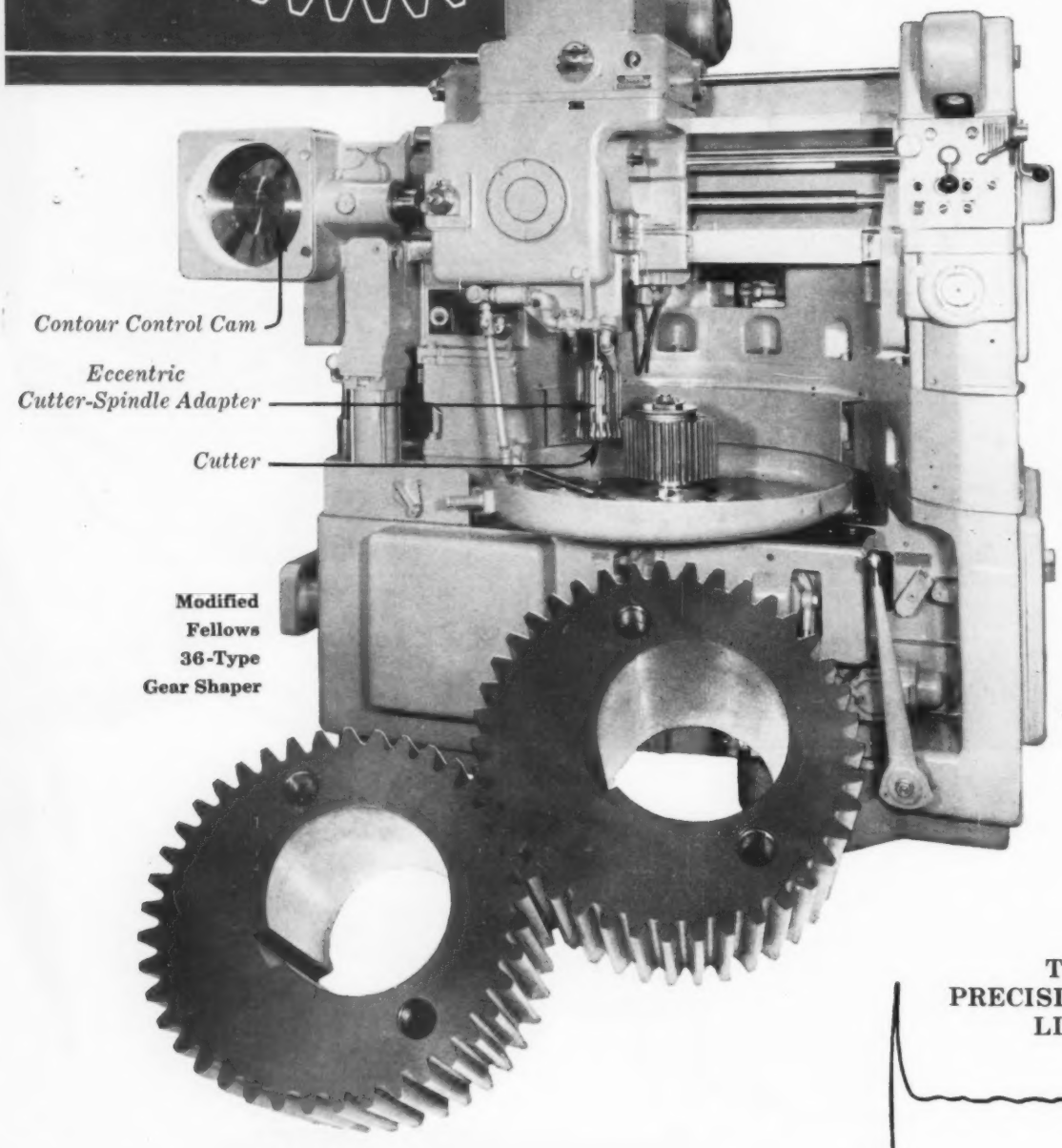
produced on



THE PRECISION LINE

OVAL GEARS

Fellows 36-Type Gear Shaper

Now...you can generate accurate oval and elliptical gears, and other irregular shapes, rapidly and economically. Once setup is made, production is as simple as in cutting conventional cylindrical gears. This new method minimizes the difficulty of wide variations in backlash experienced with such gears cut by previous methods. Full or modified involute teeth are produced to a higher degree of accuracy than was ever possible before on gears of this type.

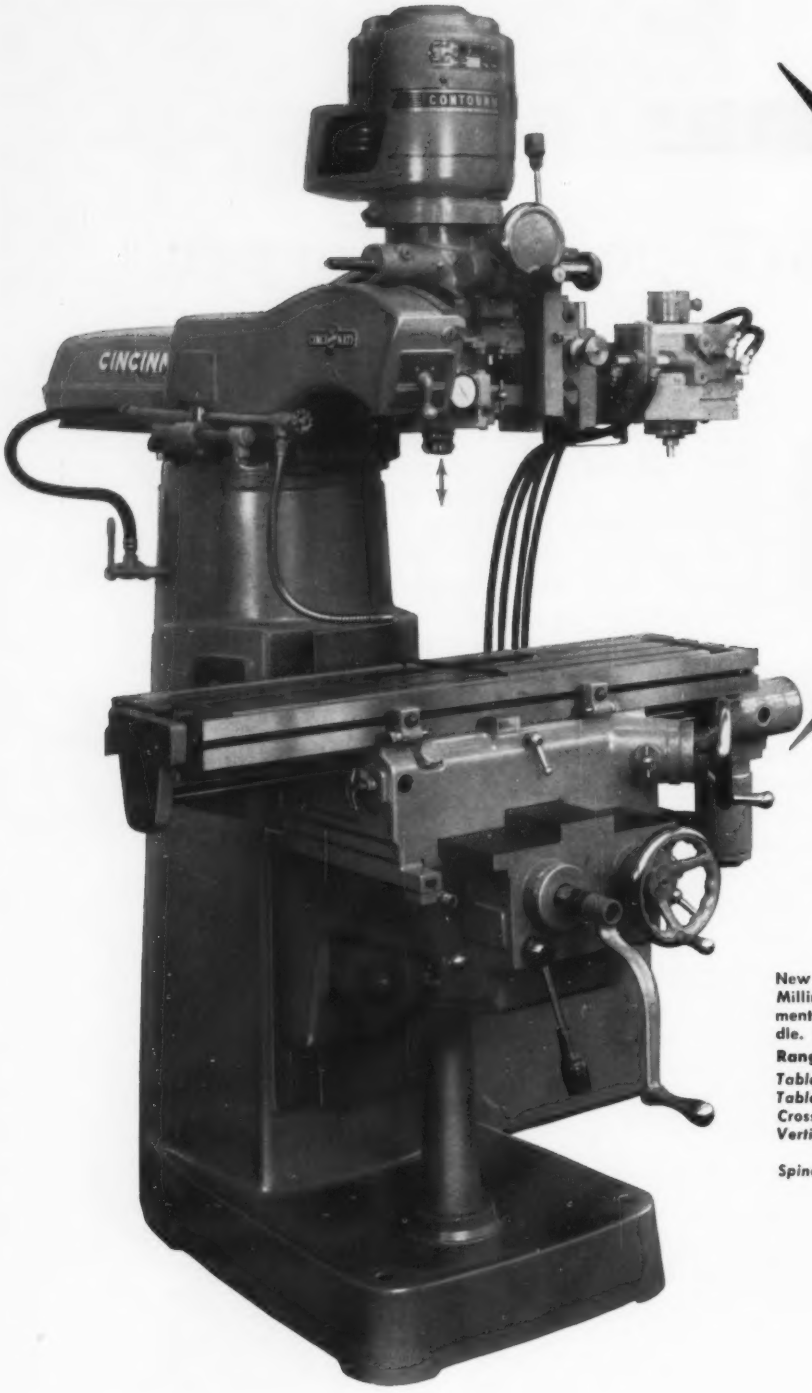
Oval and elliptical gears are produced by continuously varying the center distance between cutter and gear during the cutting operation. A contour cam and a follower move the saddle the required amount in timed relationship with the rotation of the eccentric cutter-spindle adapter. The required pitch line contour of the gear is determined by the control cam and the eccentric adapter.

Although the Modified 36-Type Gear Shaper can be used to produce conventional external gears up to 18″ pitch diameter by substituting a cylindrical cam and concentric cutter adapter, it is primarily a special purpose machine for oval and elliptical gears. Special stroke parts are required for cutting face widths from 6″ to 10″. For full information, get in touch with any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

For more data, circle this page number on inquiry card



New

New CINCINNATI No. 1C Contourmaster Milling Machine. Arrows indicate movement of the cutter spindle, table and saddle. Catalog No. M-2008.

Range and Capacity

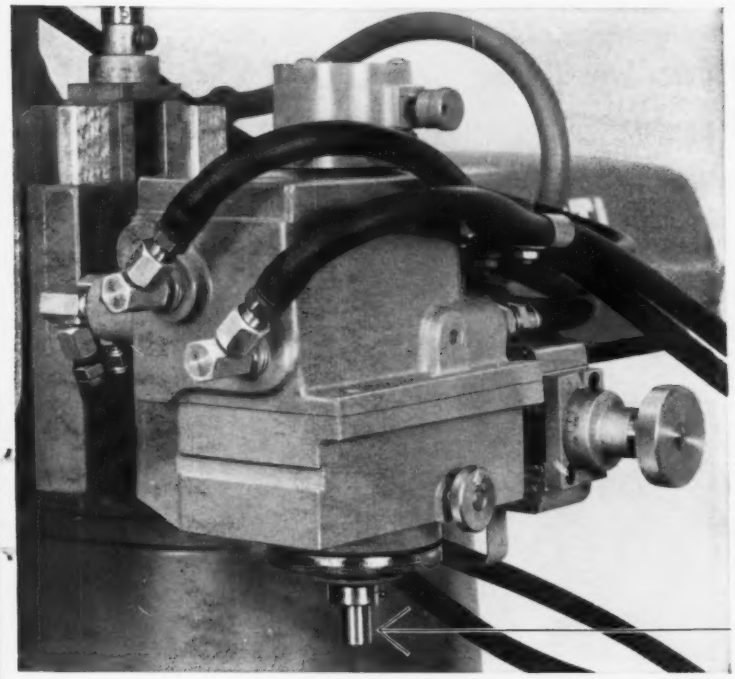
Table working surface	42" x 10"
Table traverse	22"
Cross traverse	10"
Vertical knee	17"
Vertical quill	3½"
Spindle drive motor	1 hp

CINCINNATI

CINCINNATI®

KNEE TYPE MILLING MACHINES • BED TYPE MILLING MACHINES

CONTOURMASTER 1-C



3-D Hand-Guided Hydraulic Tracer Unit, a standard feature of new CINCINNATI No. 1C Contourmaster Milling Machine. Arrow indicates tracer finger mounting stem.

FOR 3-D HAND-GUIDED HYDRAULIC TRACER MILLING

3-D milling has lost its high-cost status. Until recently, skillful manual manipulation of the machine sliding units or two types of power tracing operations were required. CINCINNATI No. 1C Contourmasters have changed all this. These new milling machines retain all the familiar Contourmaster advantages, and in addition, they are equipped with a three-dimensional hand-guided hydraulic tracer unit which provides the operator with easy power steering of the cutter and work in relation to each other. Any practical 3-D contour can be milled. Operation is easy to learn; just deflect the stylus (tracer finger) in the direction of movement desired.

Any desired combination of feed movements may be selected:

1) **All three movements active . . . for complete three-dimensional control**
2) **Vertical movement of spindle "blocked out" for 360 degree profiling in a horizontal plane**
3) **Cross feed "blocked out" for vertical profile milling using vertical and table feed movements**
4) **Table feed "blocked out" for vertical profile milling using vertical and cross feed movements**

And straight cuts in horizontal profile milling operations will proceed with very little manual attention. The stylus is merely deflected and locked in position while milling the straight length of the profile. For conventional toolroom milling, the tracing unit can be quickly disengaged. Hand feed controls are then employed. ¶Check into the many advantages of new CINCINNATI 1C Contourmasters for your tool and die shop. Complete information will be found in catalog No. M-2008.

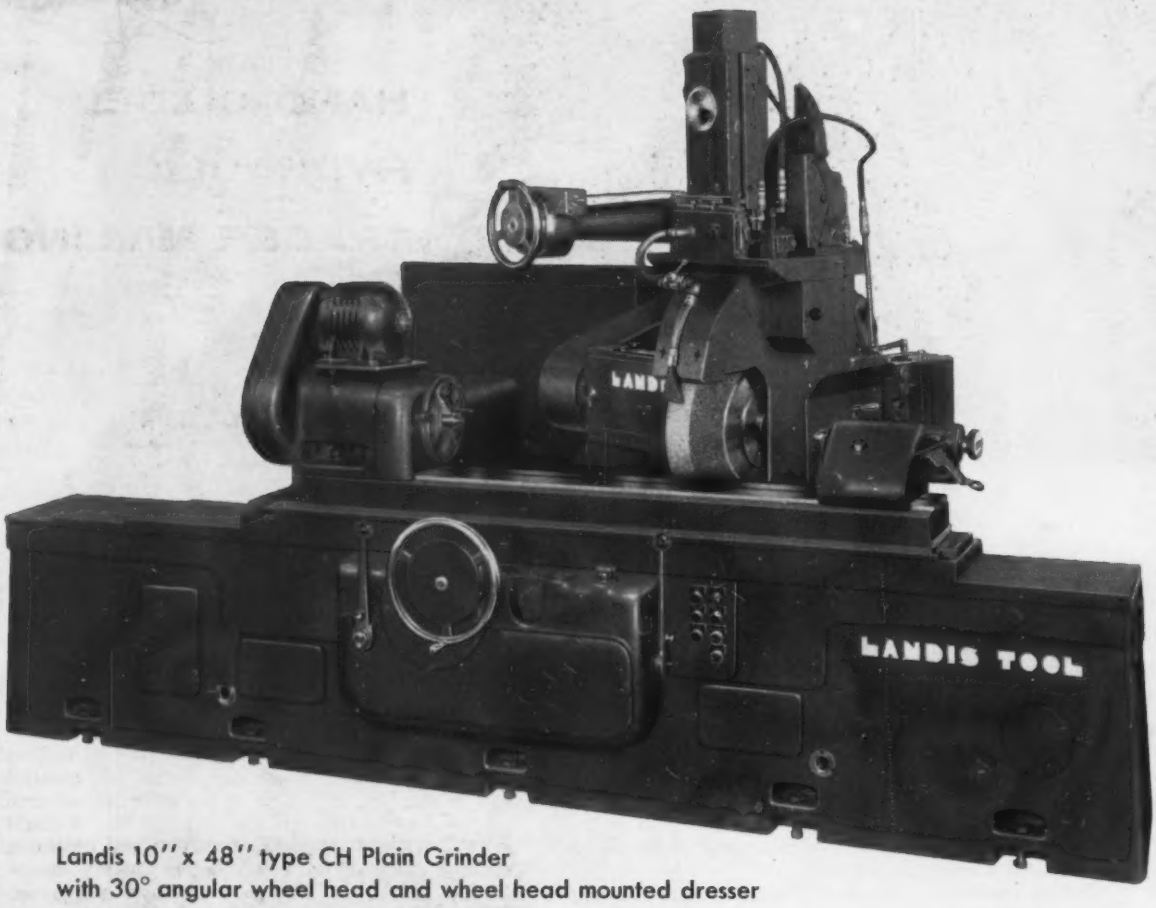
DIE SINKING MACHINES • CUTTER AND TOOL GRINDERS

MILLING MACHINE DIVISION
The Cincinnati Milling Machine Co.
Cincinnati 9, Ohio

For more data, circle this page number on inquiry card

One new Landis grinder over *three* older machines

Landis plain grinder with 30° angular wheel head grinds 3 diameters and face at one time. Replaces 3 single operation grinders.



Landis 10" x 48" type CH Plain Grinder
with 30° angular wheel head and wheel head mounted dresser

LANDIS
precision grinders

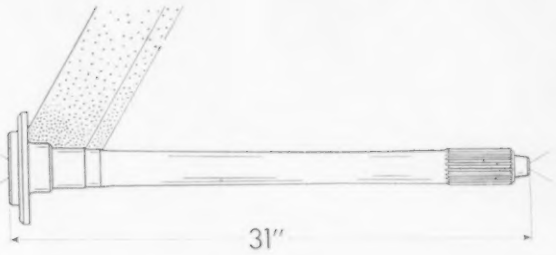
LANDIS TOOL COMPANY

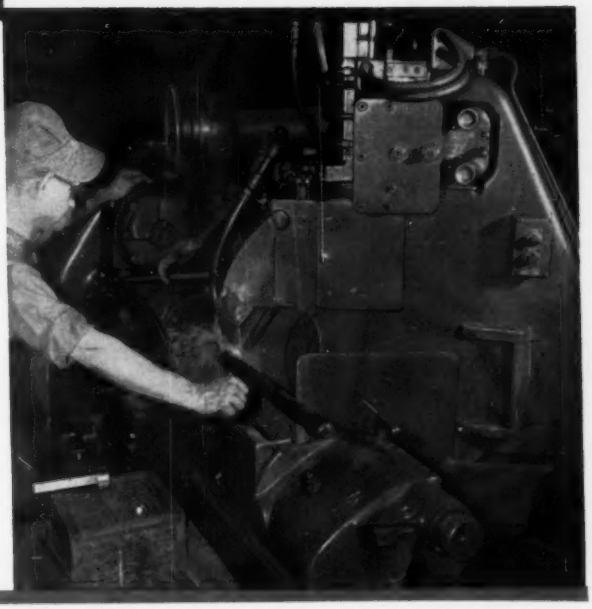
steps up production 20%

production data

Machine:	New Landis 10'' x 48'' type CH Plain Grinder with 30° angular wheel head
Part:	Tractor axle
Operation:	Infeed grinds 3 diameters and adjacent face in one operation
Production:	35 parts per hour
Material:	9490 "H" steel forging
Hardness:	40-46 Rockwell C
Stock removal:	.020''-.023'' on diameters .008'' on face
Finish:	16 RMS on diameters 32 RMS on face
Tolerance:	.0005'' on diameters

Accurate wheel dressing is obtained with the hydraulically operated profile wheel dresser. The entire face of the wheel is dressed in one continuous traversing movement.





A lateral locating gauge is used to establish the correct position of the workpiece. Completely automatic feed allows the operator to dog the next workpiece during the grinding cycle.

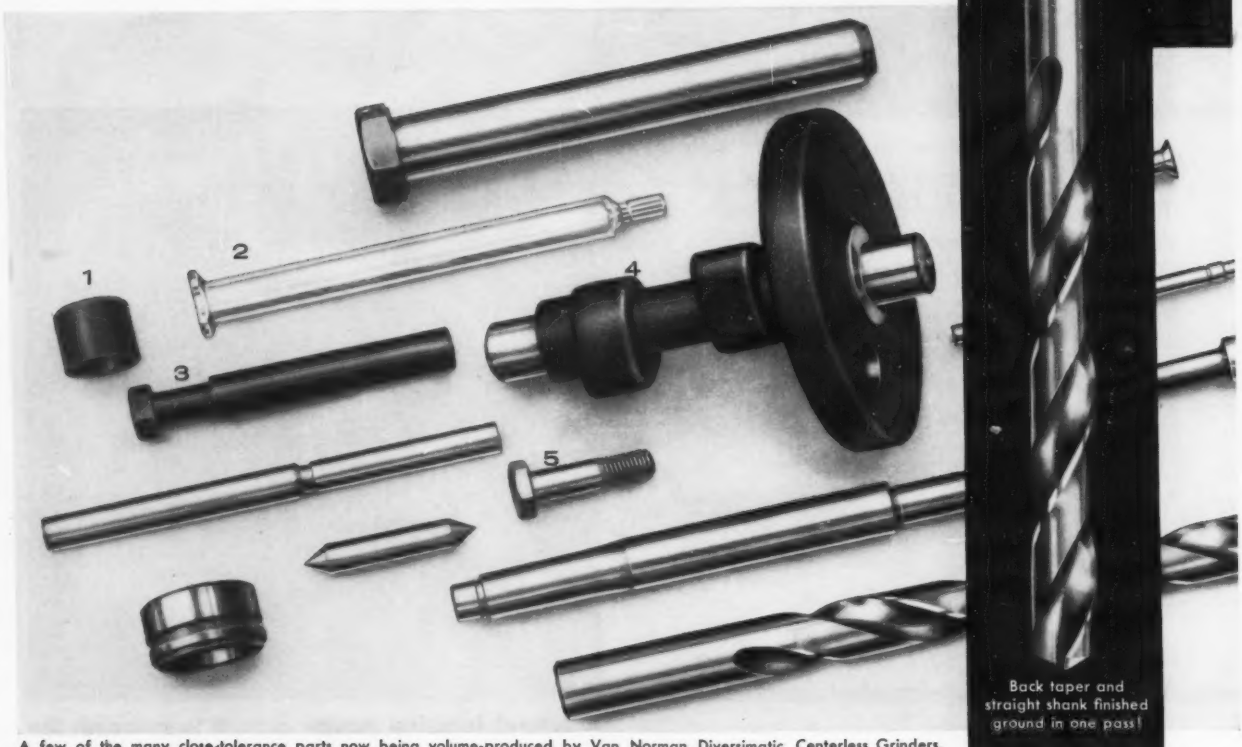
WAYNESBORO, PENNSYLVANIA

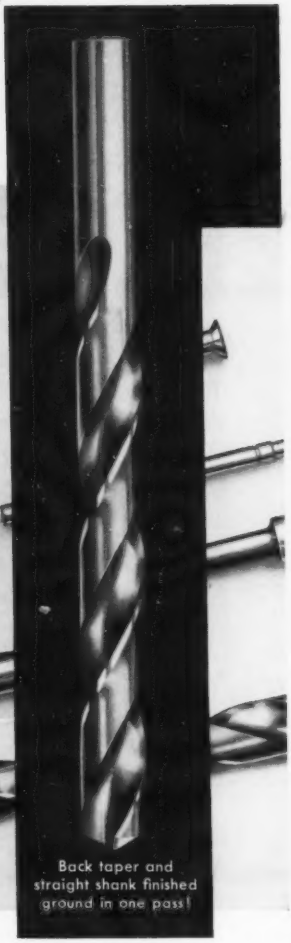
1200 close-tolerance

with a

VAN NORMAN 2C *DIVERSIMATIC**

CENTERLESS





Back taper and straight shank finished ground in one pass!

A few of the many close-tolerance parts now being volume-produced by Van Norman Diversimatic Centerless Grinders. Part #1 is made of graphite; #2, glass; #3, plastic; #4, cast iron; #5, Titanium. All other parts shown are steel.

VAN NORMAN MACHINE

SPRINGFIELD 7, MASSACHUSETTS

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinder .

finished ½" drills per hour—

Using a 2C Diversimatic, with special automatic loading and unloading mechanisms, Morse Twist Drill, one of the country's largest manufacturers of precision twist drills, grinds 1200 high speed ½" twist drills per hour! Stock removal is .006, grinding the back taper and straight shank in one pass, maintaining tolerances of $\frac{+.0005}{-.0000}$.

Morse is but one of many manufacturers who have found that Van Norman 2C Diversimatic Centerless Grinders help them increase production and hold down production costs. Find out now how Van Norman Diversimatic Centerless Grinders can help you with your volume-production problems — write, wire or phone now for more information.

NOTE: The Van Norman 2C Diversimatic Centerless can be equipped with the exclusive Van Norman crush-former which greatly increases the range of close-tolerance parts you can volume-produce.

COMPANY

A DIVISION OF
VAN NORMAN INDUSTRIES,
INCORPORATED

Don't wait . . . for extra profit install a Van Norman machine now!
They are available in many purchase plans . . . Outright sale . . .
Purchase on conditional sales contract up to five years . . .
Pay as you depreciate up to 10 years.
Conditional Sales Contracts not available to Export.

*T.M. Reg. U. S. Pat. Off.

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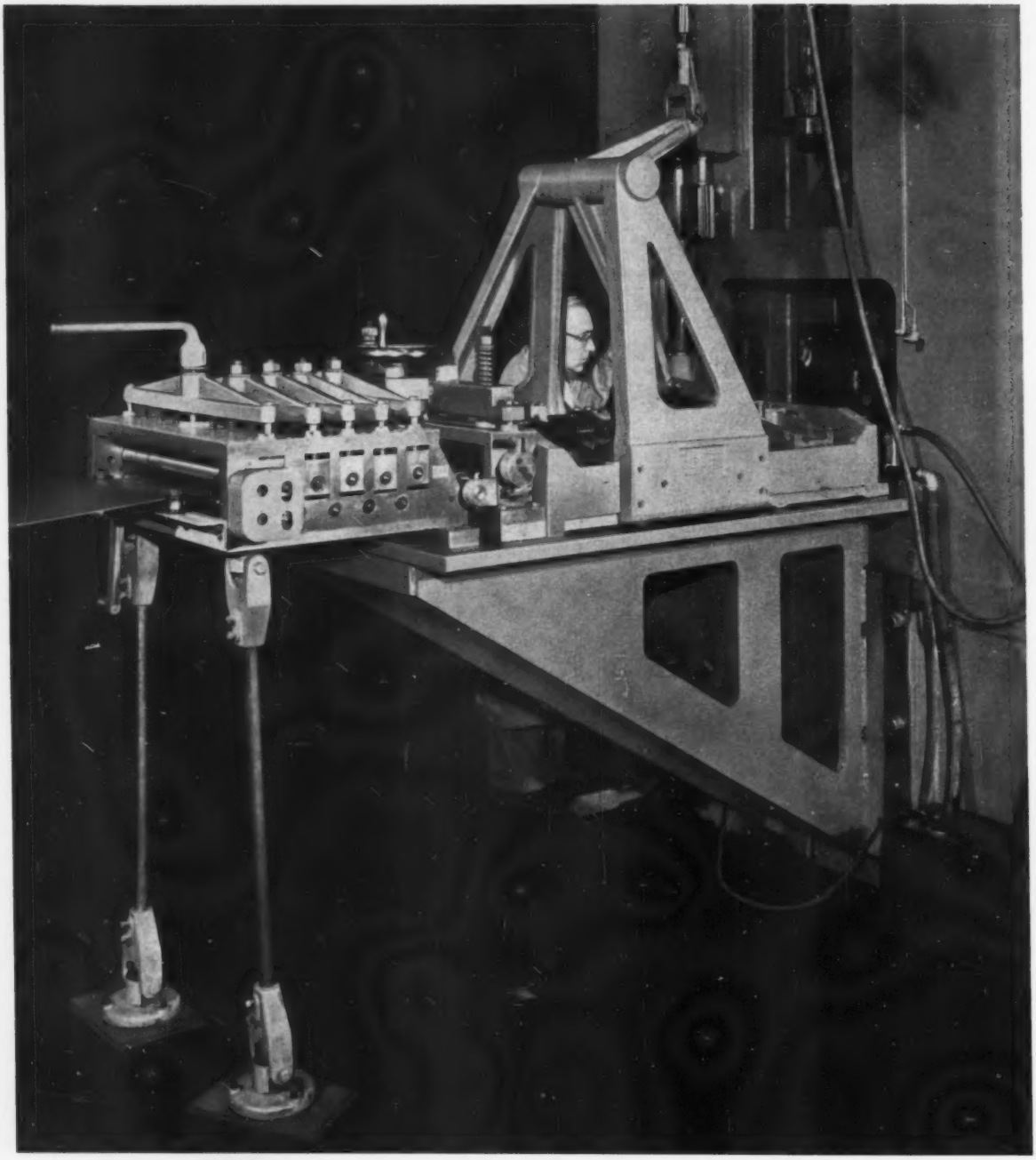
TEAMED FOR



SF-2424 U. S. Slide Feed with an SS-24-8 Plain straightener, mounted on a straight side press to feed from left to right. This combination is capable of handling stock up to 24" wide—maximum length of feed is 24".

US PRODUCTS

U. S. TOOL

Slide Feeds • Roll Feeds • Stock Straighteners • Stock Reels • Stock Oilers • Coil Cradles • Combination Cradle Straighteners • Combination Reel Straighteners • Wire Straighteners • Die Sets • Multi-Slides® • Multi-Millers®

PRESS ROOM EFFICIENCY

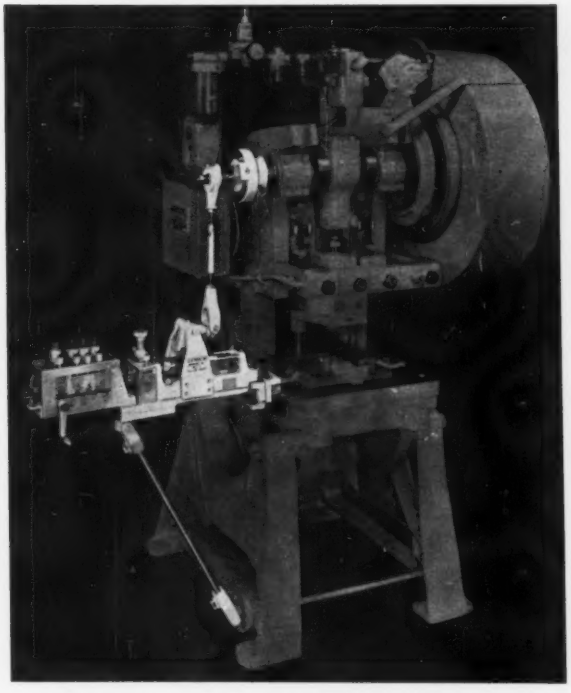
U. S. Automatic Press Room Equipment is made to team perfectly with your present presses. All units are engineered and built solely to increase the efficiency of your presses — to bring you the savings which result from the use of coil stock.

U. S. mechanical driven Slide Feeds have long been recognized by users as the most accurate automatic feeds on the market. They are built in a range of sizes with width capacities from 1½" up to 27", and all sizes can be teamed with matched Plain Stock Straighteners.

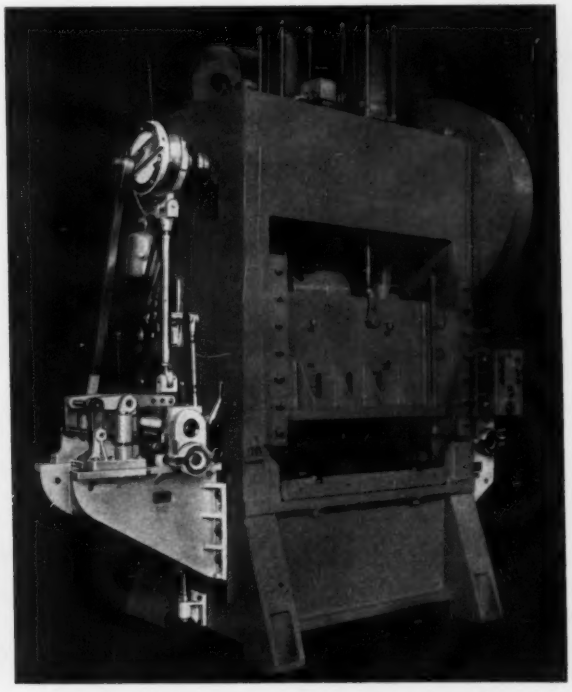
Where wire of round or irregular cross-section is to be fed, U. S. Slide Feeds are supplied with Two-way Wire Straighteners.

For certain applications, where roll feeding is desirable, U. S. Roll Feeds are available in either single or double types.

Whether you are working with .020" wire or wide flat stock, when you have U. S. equipment you have the perfect team for both short and long run jobs.



Model SF-1 U. S. Slide Feed with matching Plain Straightener, for stock widths up to 2½"— maximum length of feed 4".



Model RF-1212 U. S. Double Roll Feed (Racks and Pinion Type). Capacity: for material up to 12" in width, feed length adjustable up to 12".

Complete information about U. S. Automatic Press Room Equipment is yours by asking for Bulletin No. 85M

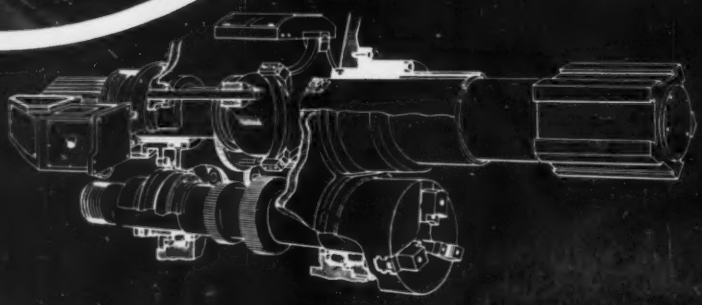
COMPANY, INC.

AMPERE *(East Orange)* NEW JERSEY

For more data, circle this page number on inquiry card

AT HUGHES AIRCRAFT COMPANY

Rigid 100% inspection on the machine! Before the part is removed from the Warner & Swasey "AC", the finish bore tolerance of .0002" is checked by the operator with an exacting Sheffield air gage shown above.



"On Target" Control of their Falcon Missiles begins on Warner & Swasey "ACs"

Hughes' Culver City, California, plant produces air-borne armament control systems for their famous Falcon air-to-air guided missile. Six Warner & Swasey Single Spindle Chucking Automatics are utilized interchangeably to produce many high precision turned components . . . consistently holding rigid missile tolerances, which, in some cases, mean .0002".

Production accuracy of Warner & Swasey Single Spindle Automatics is no accident. For example: only two wide—and widely spaced—bearing surfaces support the overhead pentagon turret, as shown on the opposite page, eliminating the cumulative tolerance problem of multiple bearing surfaces. Further, these support bearings are mounted in the same casting as the spindle, are completely enclosed, fully lubricated and subjected to exactly the same temperature. This assures holding precision tolerances constant all day, every day.

Hughes' air-borne armament control system displayed before two supersonic Convair F-102A all-weather interceptors. It directs the interceptor to the target (invading bomber) and releases the Falcon missile at precisely the most effective moment. The Falcons, with their own electronic system, then automatically "home" on the target and track it down for a fatal hit.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

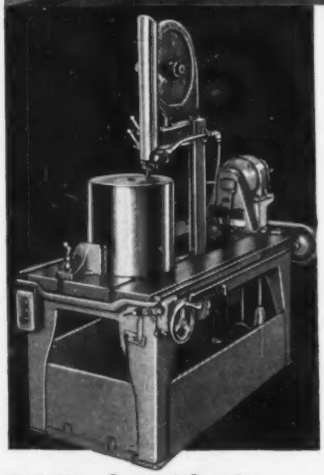
MARVEL NO. 8 BAND SAW makes a tough job EASY...

FLOOR TO FLOOR IN 5 HOURS... no special jigs, fixtures or set-up required

The versatility, simplicity of operation and unmatched efficiency of a MARVEL No. 8 Universal Metal Cutting Band Saw makes it the best all-around saw you can buy.

Take the job illustrated, as an example. Three equally spaced re-entrant cuts were required to segment a large, heavy die forging. The work was merely placed on the table between the vise jaws with the first lay-out line positioned to bisect the blade. Feed pressure was set on the direct-reading scale and the cut started. On a MARVEL No. 8, the work is always stationary and the blade is fed into the work; the cutting edge of the blade is always square with the table throughout its full feed traverse, which eliminates the need for special fixtures. The pre-set Automatic Overload-Relief Power Feed kept the blade moving into the work only as fast as it could freely remove the metal; as the vertical length of the cut decreased, the blade was automatically fed faster, thus increasing cutting speed. Upon completion of a cut, the blade was rapidly returned to its starting position by a rapid traverse handwheel located at the operator's position. Succeeding cuts were made in the same manner, with the same ease and speed.

Jobs like this aren't done every day, but they serve to emphasize the versatility of the MARVEL No. 8, a truly universal metal cutting saw. If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.



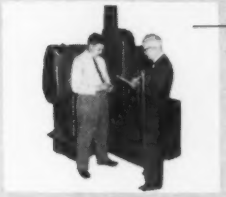
ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. · CHICAGO 39, ILL.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

S-1302

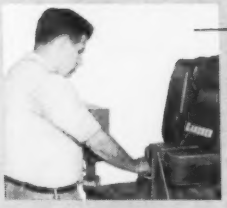
Get the right abrasive for your flat surface grinding with the Gardner Service Plan

Only Gardner combines abrasive and machine experience, because only Gardner makes both! And Gardner Abrasives Specialists concentrate on disc grinding. For maximum production, longer disc life, investigate the Gardner Service Plan:



1

A survey of your grinding operations.



2

An actual in-service trial of Gardner Discs.

3

A close check of the results.

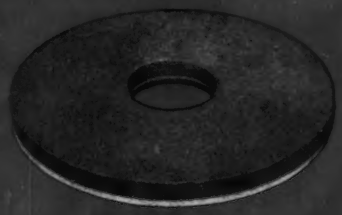
The Gardner Abrasives Specialist in your area will call at your request.

GARDNER

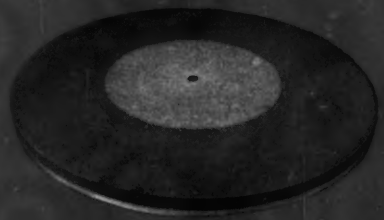
abrasive discs

BELOIT, WISCONSIN

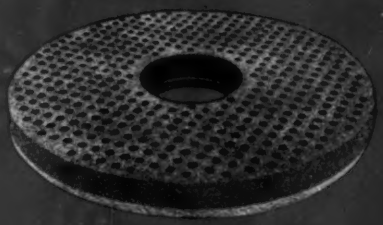
Gardner WIRE-LOKT® discs



smooth face

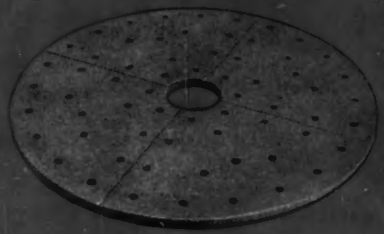


combination grade

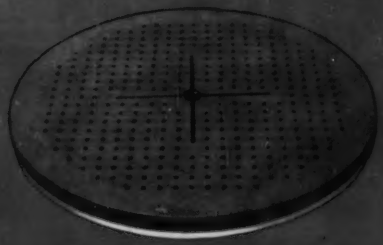


deep corrugated

cylinder type

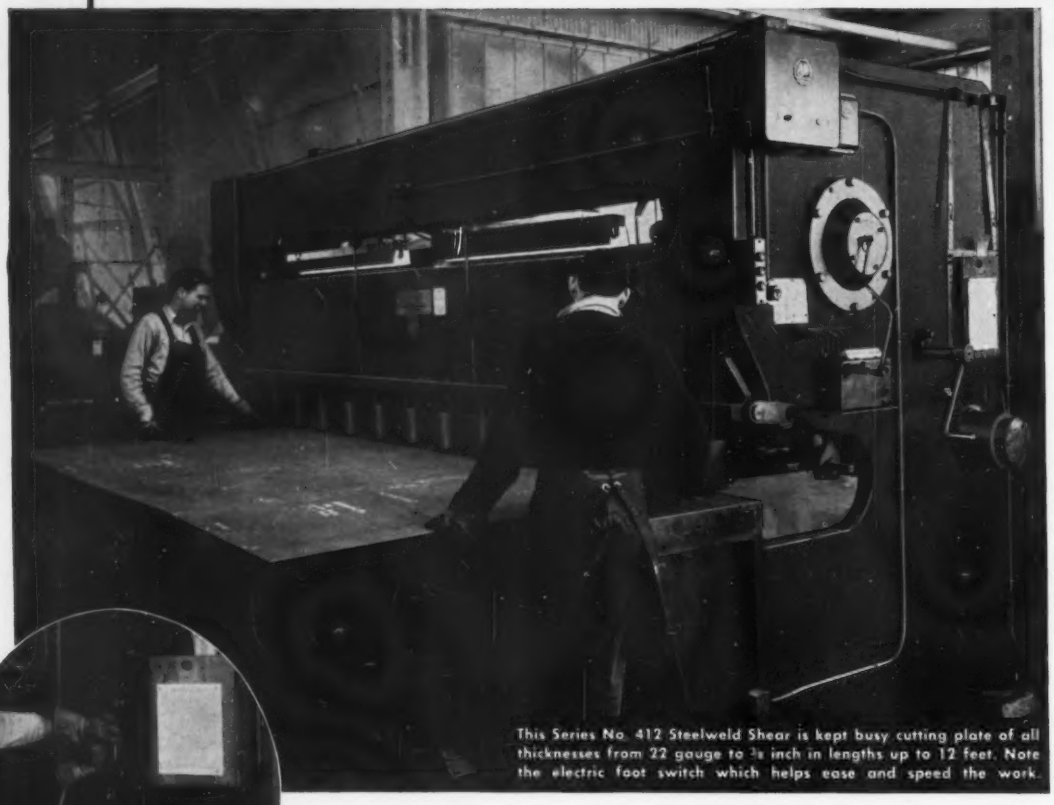


segmental



deep corrugated with radial lines

KNIVES STAY SHARP LONGER for California Steelweld Shear User



This Series No. 412 Steelweld Shear is kept busy cutting plate of all thicknesses from 22 gauge to ½ inch in lengths up to 12 feet. Note the electric foot switch which helps ease and speed the work.

One of the big reasons why knives stay sharp longer on Steelweld Shears is the simplicity with which knife clearance can be adjusted for every plate thickness. It's merely a matter of turning a hand crank until the gauge pointer is on the proper figure. No bolts to loosen. No need of a feeler gauge.

"It's a shame," said the shop foreman at Stephens-Adamson Mfg. Co., Los Angeles, California, "but since installing our Steelweld Shear the knife-sharpening man has been crying because we have no work for him."

After months of continuous operation, eight hours a day, usually six days a week, inspection of cut pieces indicates the knives are practically as sharp as new. Parts cut have no burrs and are straight and true. Even when the cutting edges of the knives finally become dulled, there are three more cutting edges ready for use as all four corners of each knife are prepared for shearing.

Stephens-Adamson like their Steelweld Shear and are happy over its operation. It plays an important role in the manufacture of screens, elevators and conveyors which are the principal products of this large West-coast plant. In their words, it is "heavy, well built and dependable. We know it is reliable and always ready to handle our work from day to day."

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5417 EAST 282nd STREET WICKCLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

CIMCOOL PRESENTS . . .

CIMPERIAL

Here is what we believe to be the most advanced, the most effective cutting fluid in the history of the industry.

CIMPERIAL is an entirely *new* chemical concentrate *especially designed for heavy duty applications*. It is the only water-miscible fluid capable of performing the tough, low clearance, low speed operations previously limited to cutting oils.

CIMPERIAL is a *chemical solution*—not an emulsion—which effectively covers 95% of all metal cutting jobs.

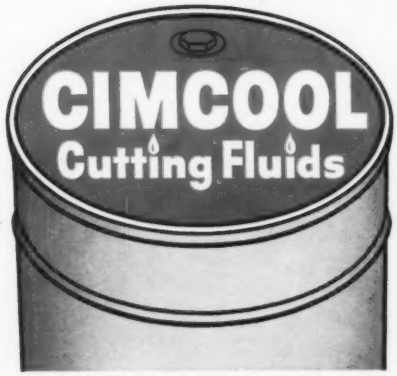
CIMPERIAL increases tool life because it defeats both heat and pressure. Forming a chemical solution in water, CIMPERIAL rapidly dissipates heat. Won't "hold" the heat as an oil will. CIMPERIAL contains newly discovered EP (Extreme Pressure) additives which give you more cutting action with less force. Result: *production equal to, or better than, oil; and working conditions vastly improved.*

Note these important advantages:

CIMPERIAL lasts longer. It won't turn rancid: it contains no food for bacteria and has a remarkable bactericide to control those bacteria that do enter the mix from outside sources. No more Monday morning odor. Less frequent coolant changes mean lower costs, less down time for machines.

CIMPERIAL is productive and clean. The *new* EP chemicals reduce the cutting forces and friction on the tool: in one case CIMPERIAL has already increased tool life 70%. It also has high film strength for lubricity characteristics better than oil. And there is no smoke or vapor around your machines.

CIMPERIAL controls rust. You get *two* types of chemical rust inhibitors in CIMPERIAL . . . which form both *polar* and *passivating* films over metal surfaces. This gives you, even at lean dilutions, double protection against corrosion.



FOR 100% OF ALL METAL CUTTING JOBS

Production-proved products of The Cincinnati Milling Machine Co.

CIMPERIAL—*newest* in the famous, industry-proven line of CIMCOOL® Cutting Fluids!
CIMCOOL S2 Concentrate—The pink fluid which covers 85% of all metal cutting jobs.
CIMPLUS—The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, SS)—For every job requiring an oil-base cutting fluid.
ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.

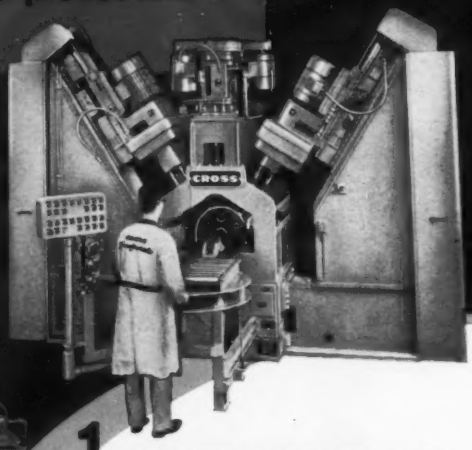
For full information on great new CIMPERIAL and the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor today. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

®Trade Mark Reg. U. S. Pat. Off.

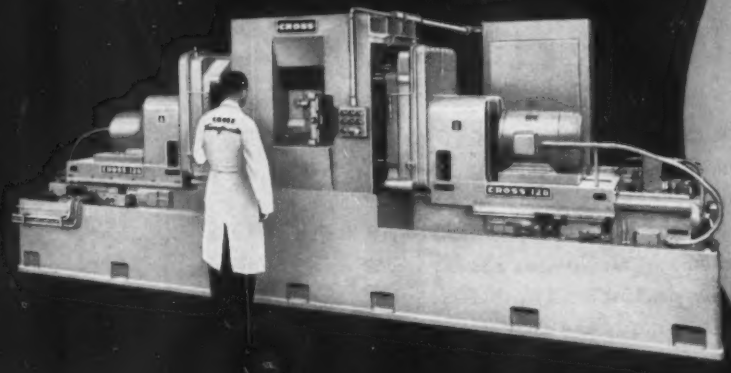
For more data, circle this page number on inquiry card

6 ways to automate

Cross automation takes many forms . . . from the simplest low production machines to complex equipment for mass production.



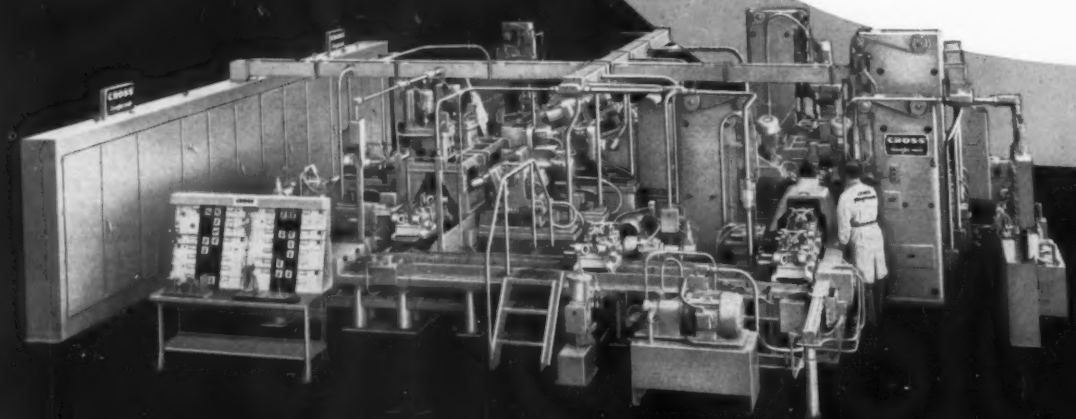
1 **CROSS SINGLE STATION MACHINES** exist in many configurations to combine operations.

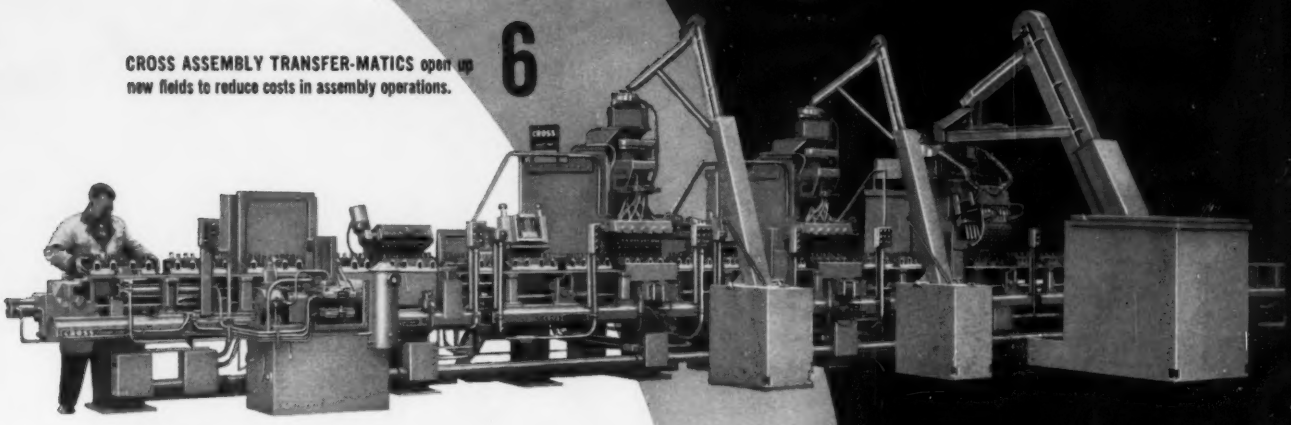


2 **CROSS DIAL TYPE MACHINES** provide multiple station performance with minimum floor space.

3 **CROSS TRUNNION TYPE MACHINES** are compact multiple station units that permit operations on opposite sides of the part.

4 **CROSS PALLET TYPE TRANSFER-MATICS** provide capacity for combining a large number of operations. Standard pallet fixtures handle irregularly shaped parts with maximum flexibility.

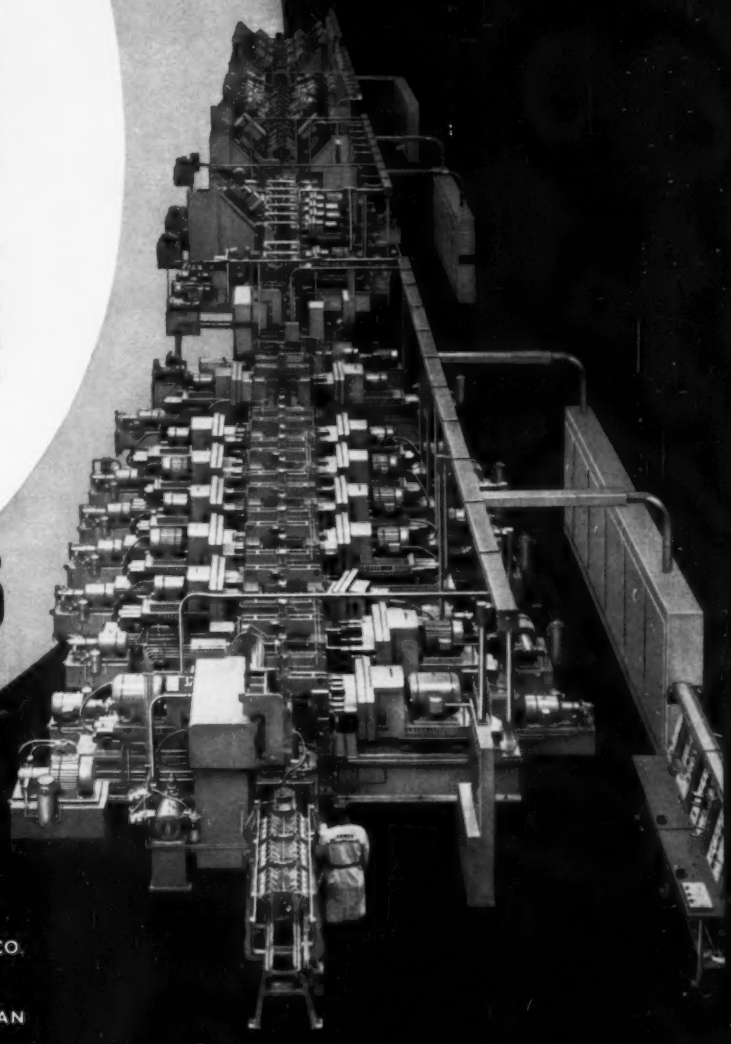




CROSS ASSEMBLY TRANSFER-MATICS open up new fields to reduce costs in assembly operations. **6**

The six machine types illustrated here were created by Cross to apply the principles of automation to a wide variety of metalworking operations. Thus, Cross makes available the benefits of automation to small or large manufacturers, regardless of required production volume.

Cross sales engineers are available to discuss your automation problems with you. They will also be glad to discuss the new Cross Process Development Service created to solve *unusual* automation problems—in or out of the metalworking field.



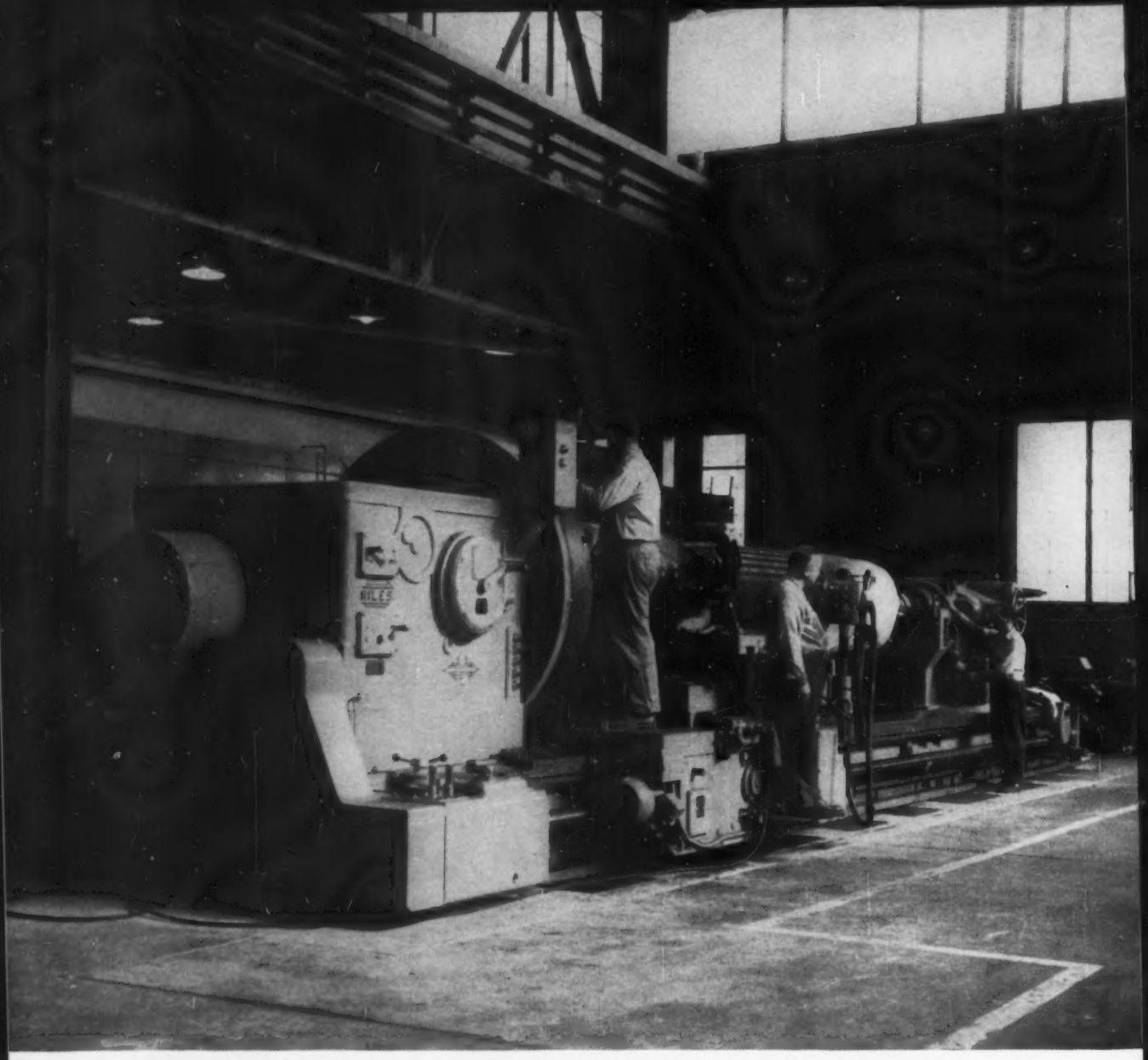
CROSS SECTIONIZED TRANSFER-MATICS provide a means of combining unlimited numbers of operations. Automatic in-process work storage minimizes downtime and increases operating efficiency. **5**

Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



This new 72 in. x 38 ft. Niles Lathe recently installed at the Consolidated Edison Co. of New York repair shop at Astoria can handle all the rotary fields and three-fourths of the high-speed turbine spindles in the company's network of generating plants.

In machine shops the world over Niles and Hamilton Tools save thousands yearly

For more than 130 years, the Hamilton Division of the Baldwin-Lima-Hamilton Corporation has been designing and building the world's finest machine tools. From routine day-to-day rebuilding and repairing of old tools to the design and manufacture of one of the world's largest boring mills (43 ft.) for shipment to Italy, Hamilton serves industry worldwide. And as every railroader knows, Niles represents the world's most complete line of railroad wheel and axle maintenance tools. In industrial machine shops around the globe, Niles and Hamilton tools save thousands of dollars a year.

Hamilton Division Hamilton, Ohio

BALDWIN · LIMA · HAMILTON

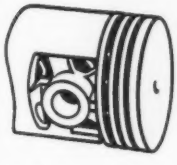
Diesel engines • Mechanical and hydraulic presses • Can making machinery • Machine tools & general machinery

For more data, circle this page number on inquiry card

POSITIVE DUPLICATION – EVERY TIME!

(PD) ° Exact duplication of one person's fingerprints by another person is impossible. Discovery of this amazing fact in 1891 changed the science of detection and identification throughout the world.

But Positive Duplication of grinding wheels by the CINCINNATI (PD) manufacturing process is a remarkable fact also . . . time after time !



Every time you reorder the centertype wheel shown above, which grinds this automobile piston, that CINCINNATI (PD) wheel will act and grind exactly like the original . . . saving you time and money, and maintaining your production.

This is true of *any* CINCINNATI (PD) WHEEL you specify: centertype, centerless, internal, surface, toolroom, and snagging wheels.

Another advantage for you is that every factory representative is a highly trained specialist in grinding machine set-ups and operations. For his help on those extra-tough grinding problems, see your CINCINNATI (PD) Grinding Wheels Distributor or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI

GRINDING WHEELS

°Trade Mark Reg. U. S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

For more data, circle this page number on inquiry card

PORTA-CHECK®
A transistorized portable comparator for fast accurate measurement in both "tenths" and "thousandths" scales.

MODEL AG AIR GAUGE
For checking diameters, dimensions, roundness, etc.

AMES

Masters of Measurement...

For more than half a century, Ames measuring instruments have been regarded as the finest made. Today the constantly growing line of Ames indicators, gauges, micrometers and comparators includes such amazingly accurate instruments as the new Ames "PORTA-CHECK", an electronic comparator which gives accurate readings *in millionths of an inch*; and the new Model AG air gauge—also accurate to millionths of an inch. Wherever precision is *really* important . . . you'll find Ames "masters of measurement" on the job.

Representatives in Principal Cities

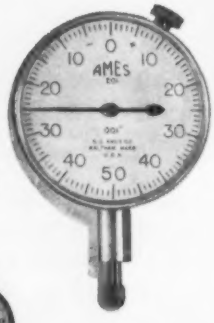
B.C. AMES CO.

27 Ames Street, Waltham 54, Mass.

Canadian Office — B. C. Ames Co., 45 Oriole Parkway, Toronto

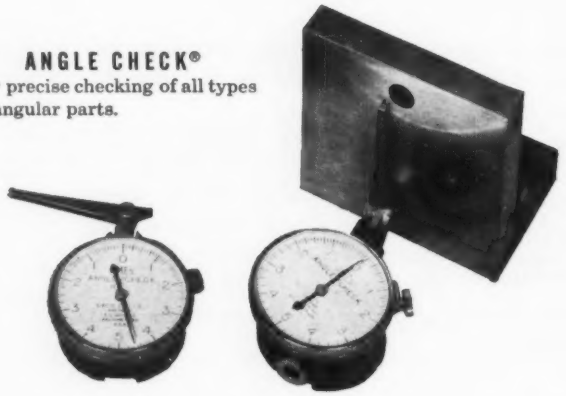
MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES

200 SERIES MICROMETER DIAL INDICATOR
One of four sizes. Made to AGD specifications.



NO. 2 DIAL COMPARATOR
For desk, bench or at-the-machine inspection of small parts.

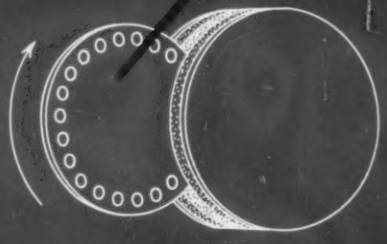
ANGLE CHECK®
For precise checking of all types of angular parts.



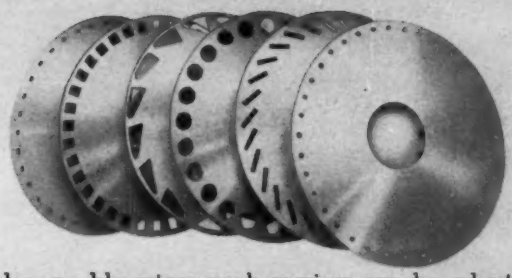
Interchangeable work carriers add profitable versatility to Gardner Disc Grinder

...rotary work carriers handle wide variety of parts in grinding two parallel surfaces in one operation

Gardner 2H30 precision double spindle grinder with rotary work carrier



Rotary work carrier is a high production means of grinding two parallel sides in one operation. Loading and unloading can be manual or automatic.



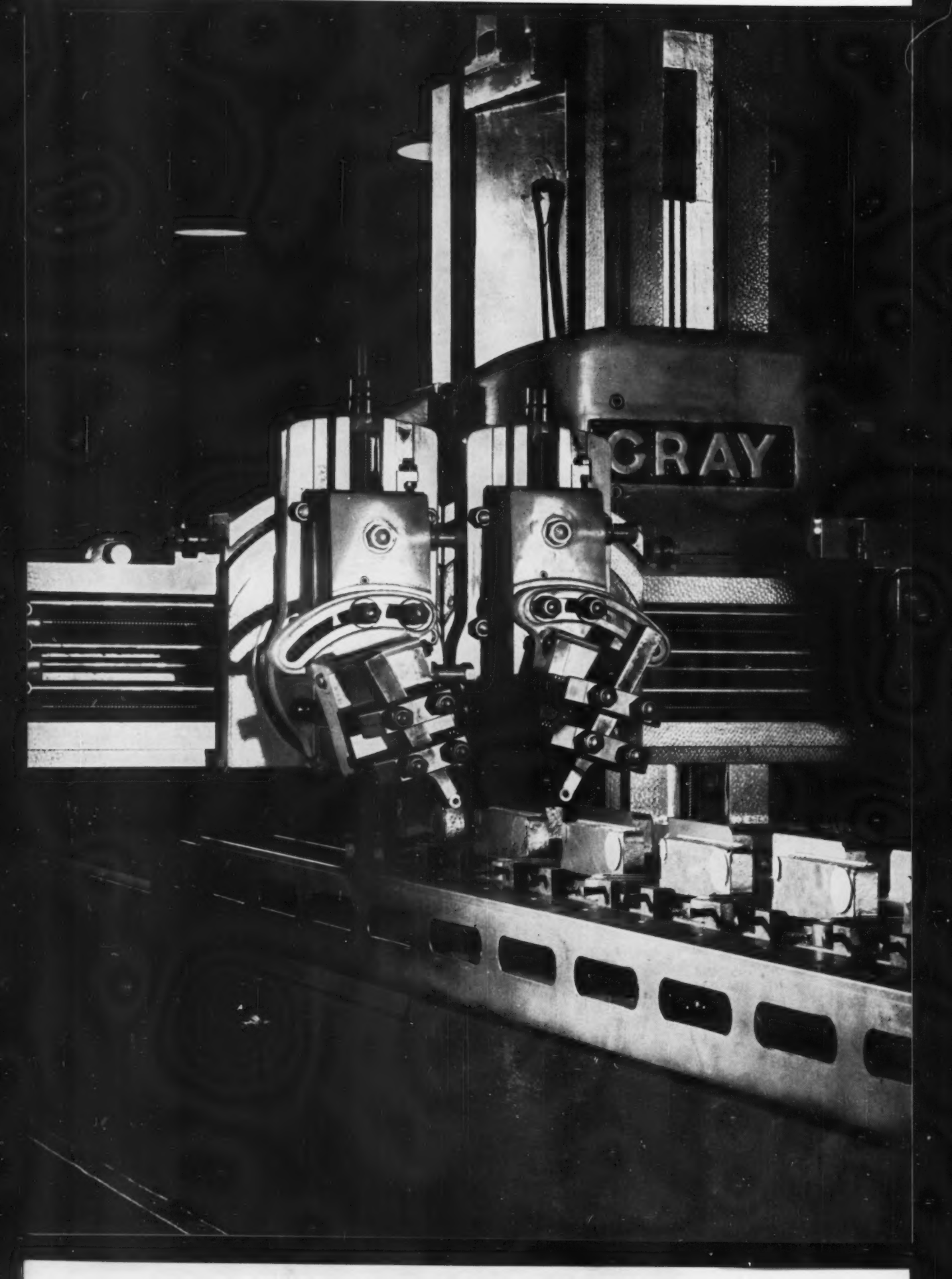
Interchangeable rotary work carriers can be adapted for workpieces of many shapes.

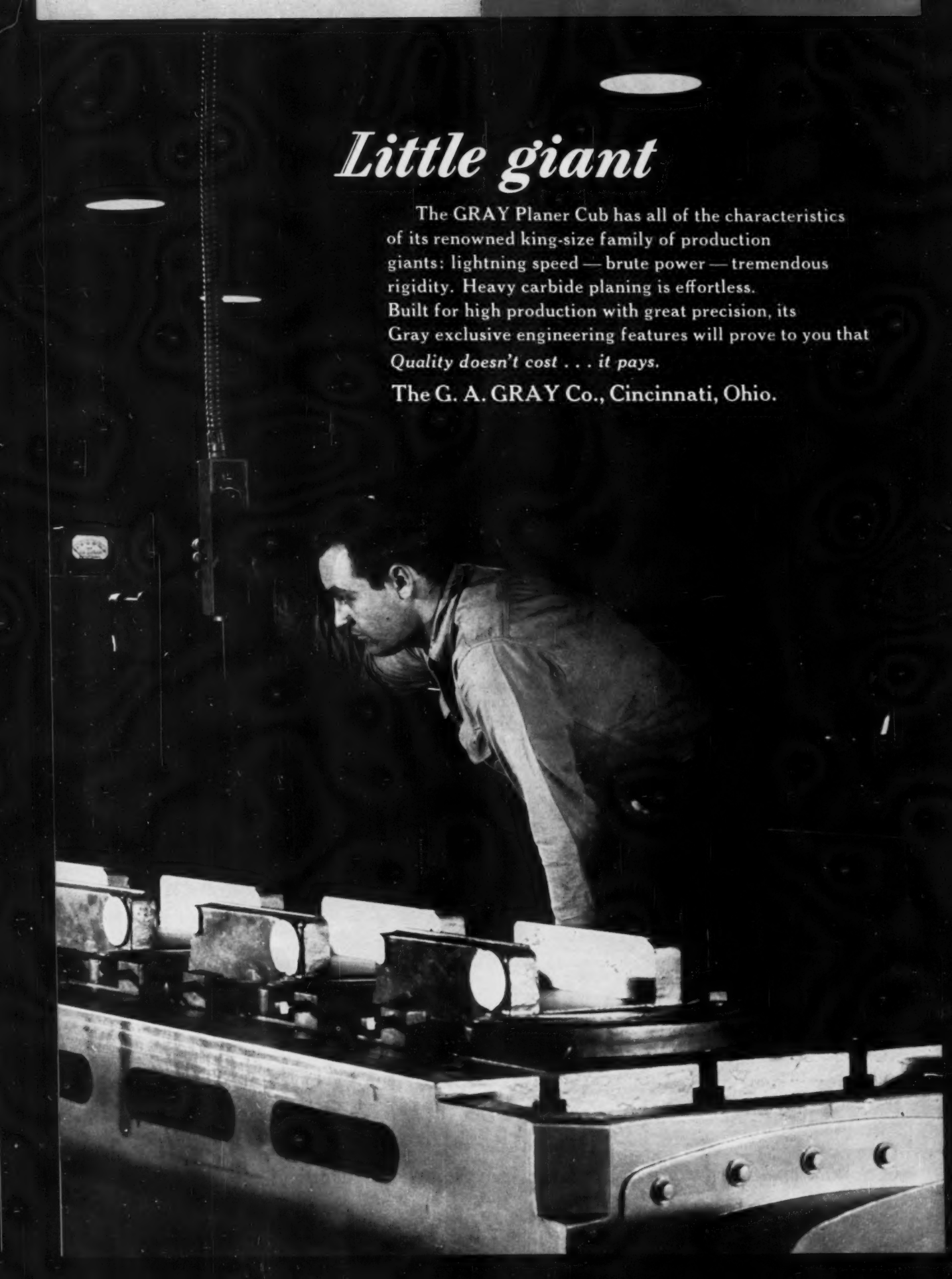
Typical parts: ..... washers, rings, bearing rollers, bearing races, gears; metal, ceramic, plastic, etc.
Production: ..... 600 to 2100 parts per hour
Stock removal: ..... .008" to .010"
Flatness: ..... .0001"-.0003"
Parallelism: ..... .0001"-.0004"
Uniformity: ..... .0015"-.002"

GARDNER

precision disc grinders

BELOIT, WISCONSIN


GRAY


Little giant
The GRAY Planer Cub has all of the characteristics of its renowned king-size family of production giants: lightning speed — brute power — tremendous rigidity. Heavy carbide planing is effortless. Built for high production with great precision, its Gray exclusive engineering features will prove to you that *Quality doesn't cost . . . it pays.*
The G. A. GRAY Co., Cincinnati, Ohio.

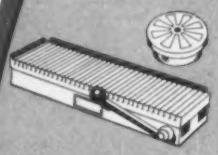
O.S.Walker

a new line of *Demagnetizers* by the originators of "engineered demagnetization"*

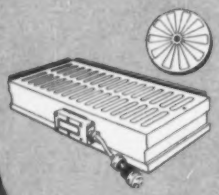
A complete line of demagnetizers from standard portable models to highly engineered magnetic amplifier controlled and compensated resonant units. • Standard units available for conventional use. • Special adaptations for automated production procedures. • Instruments for establishing residual magnetism tolerances and production inspection. • Engineering and laboratory facilities available for analysis of your demagnetization problem. • New approaches to demagnetization through Walker engineering research and experience.

*"Engineered Demagnetization" is the practical reduction of residual magnetism to specific tolerances. Send us your demagnetization requirements and let us recommend the lowest cost demagnetizer to do the job.

O. S. WALKER COMPANY, INC.
WORCESTER 6, MASS.

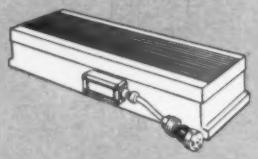


• Permanent magnetic chucks, 6 x 10" to 12 x 24", and rotary chucks from 4" to 48" dia.

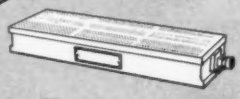


• Electro-magnetic chucks, in 172 sizes, 4 x 8" to 36 x 96", and from 6" to 122" dia.

• Standard and special demagnetizers, and instruments for measuring residual magnetism.



• Bar pole electro-magnetic chucks, in 81 sizes, 6 x 12" to 36 x 96". Concentric gap chucks in 7 sizes, 6 x 12" to 12 x 24".

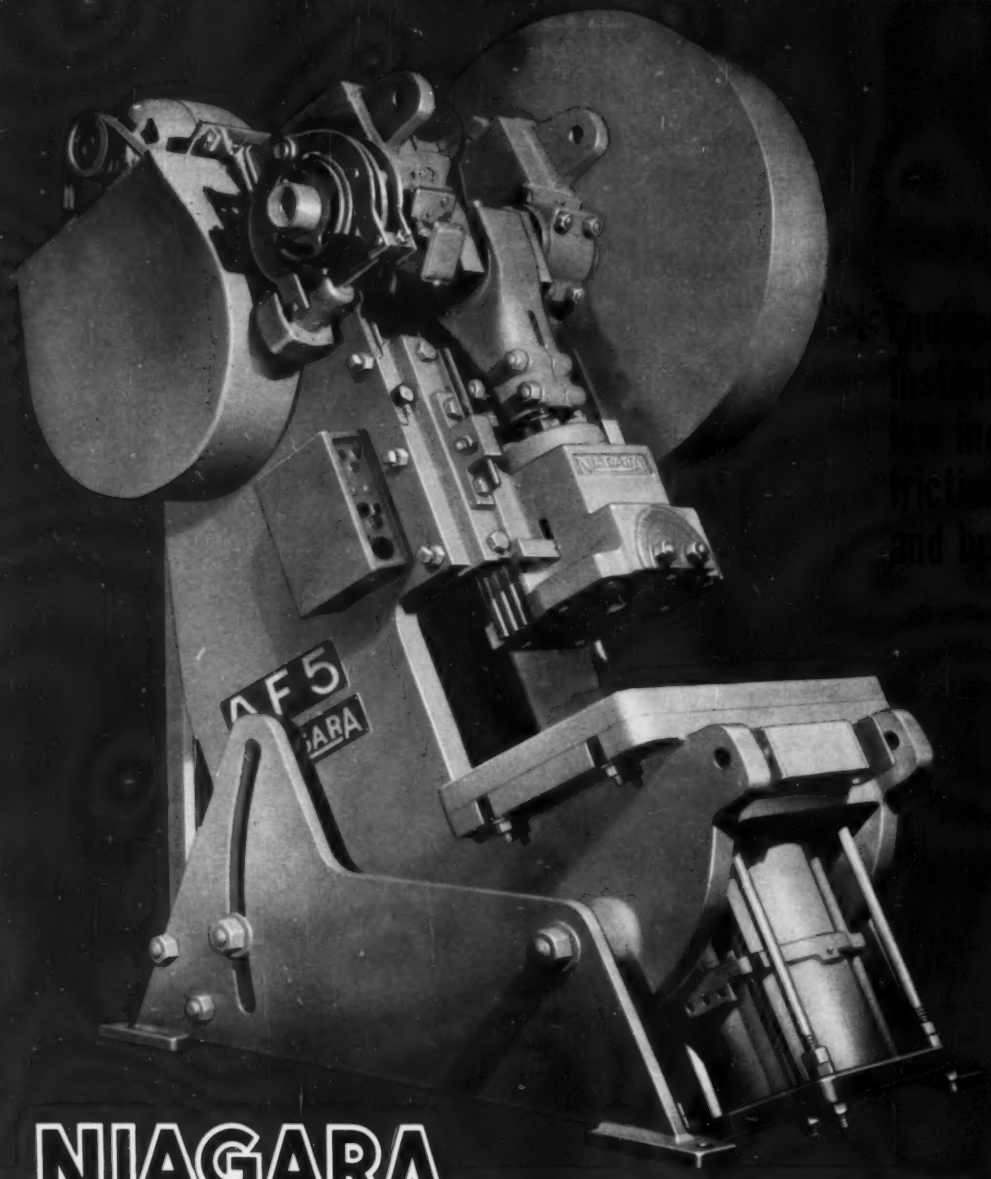


• Vacuum chucks in any size and shape for holding non-ferrous parts.

• Special electro and permanent chucks and magnetic holding fixtures are a specialty at O. S. Walker.

O.S.Walker—The Original Designers and Builders of Magnetic Chucks!

A GREAT NEW LINE* JOINS NIAGARA'S BIG OBI FAMILY



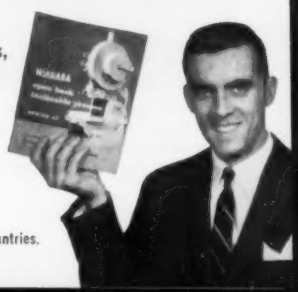
NIAGARA

Meet the new Series AF. Look it over . . . typical Niagara engineering from crown to base . . . every detail a benefit to you.

- Rugged, rigid frame for greater accuracy, longer die life.
- Unusually long, rigid slide of unique design prevents deflection of ways, solidly supports dies and extends their life.
- Exclusive multiple "V" gibbing for more guiding surface and greater resistance to off-center loads.
- Cool-running, long-wearing, pneumatic friction clutch and brake operate directly on the crankshaft . . . fewer parts to start and stop . . . faster engagement.
- Modern, rigidly supported gearing runs in sealed oil bath for long life.
- Simplified control for safer, time-conserving press operation.
- Patented one-man inclining mechanism.
- Full complement of accessories to meet your specific needs.

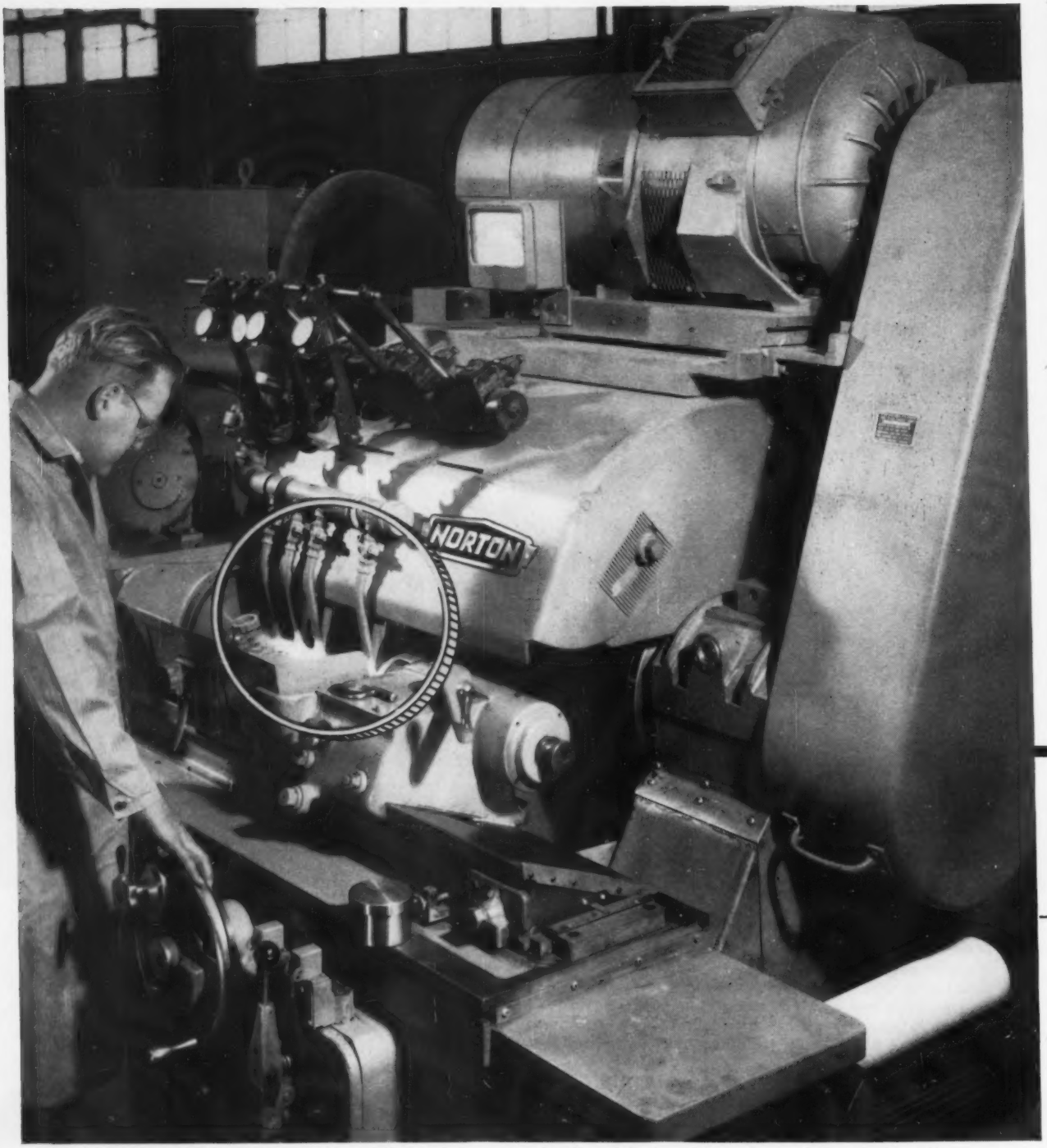
Look at the range: 14 sizes, geared and non-geared, shaft diameters 1¼" to 7½", capacities 5½ to 250 tons.
Niagara Machine and Tool Works, Buffalo 11, N. Y.

Now get the whole story . . .
Send for New Bulletin 55.



DISTRICT OFFICES: Boston • Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia / Distributors in principal U.S. Cities and major foreign countries.

Grinding multi-diameter parts



Replacing Four Separate Grinders, a Norton CM-1 grinds four diameters simultaneously — in a fraction of the time it used to take to finish this job. A great new production tool, the Heavy Duty Multi-Wheel CM-1 can perform even more grinding operations at once — on crank and camshafts, transmission and motor shafts and other multi-diameter parts. The machine has also been arranged for grinding pin diameters in multiple on crankshafts with pins lying in the same plane. And power-assist loading mechanism is available for many applications.

this fast, easy, accurate way...

Norton Type CM-1 Multi-Wheel Grinder reduces your operating expenses and capital investment by completing several jobs at once

You can get one grinding machine that does the work of several, in a fraction of the working time — bringing you considerable savings on purchase costs, operating costs and floor space.

That machine is the Norton Type CM-1 Heavy Duty Semiautomatic Multi-Wheel Grinder.

The CM-1 makes four or more cuts in a single plunge-grind cycle, operating automatically under one-lever control. And it completes each separate grinding operation with the accurate, trouble-free performance that's built into every Norton grinding machine.

Typical Advanced Features

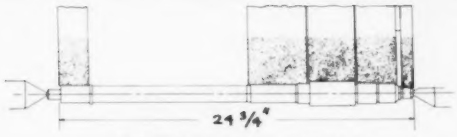
- Cartridge type bearings at each end of heavy, 10″-diameter wheel spindle assure extreme rigidity of spindle, longer wheel life, greater accuracy and control with minimum truing.
- Automatic truing device — in rear, out of operator's way — trues straight or formed wheels each individually, yet all at once, thus requiring only the amount of time needed to true widest wheel.
- Automatic compensation for wheel wear, and amount trued off. No adjustment or resetting of wheel needed after truing.
- Optional equipment includes built-in automatic sludge remover and coolant filter, constant peripheral wheel speed control, automatic work loading and unloading equipment.

Why not get the complete story of how the CM-1 can bring the cost-reducing, profit-boosting "Touch of Gold" to your grinding operations? See your Norton Representative, or write us direct. And remember: only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

To Economize, Modernize with **NEW**

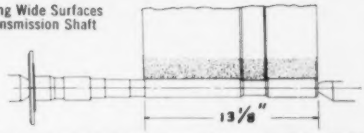
NORTON

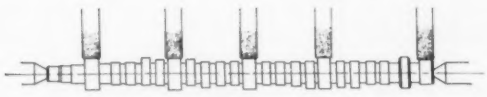
GRINDERS and LAPPERS



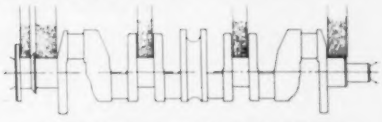
Combining Five Cuts on Transmission Shaft

Grinding Wide Surfaces on Transmission Shaft





Plunge Grinding Five Camshaft Bearing Diameters



Grinding Line-Diameters on Automotive Crankshaft

Versatility that Meets Many Needs. On the CM-1, workpieces can be up to 36″ in length. As shown in these four typical diagrams, grinding wheels can be located, close together or far apart, as required. And regardless of the number of wheels in any group, their combined widths — plus spacing collars — can total up to 30″, exceeding the widest group shown here. This Norton-engineered versatility brings progress and profits to your diameter grinding — because with the CM-1 you can actually finish a group of line-diameters in approximately the time you've been spending on a single diameter grind.

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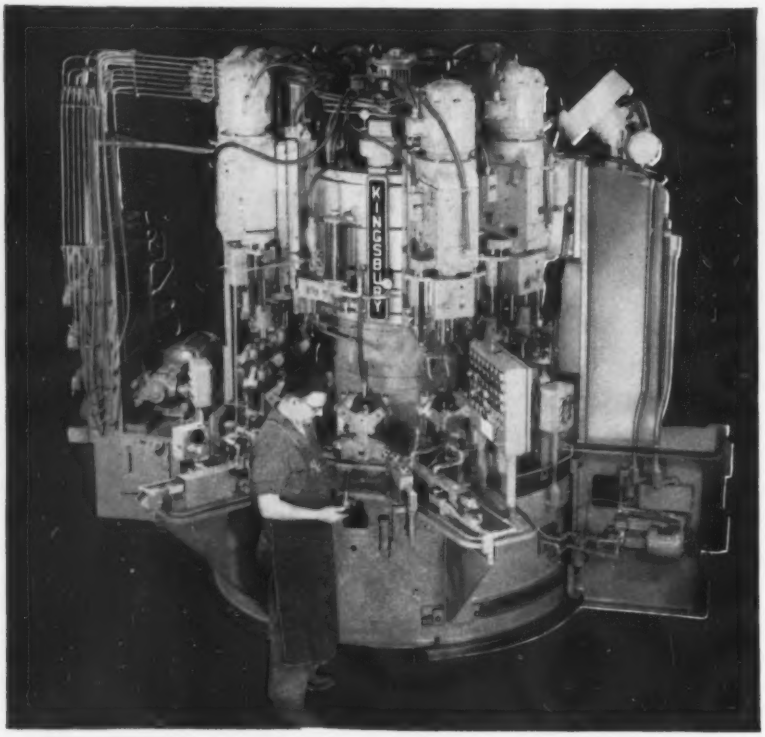
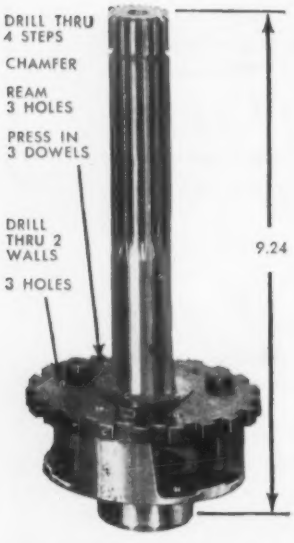


New 24-spindle Kingsbury has hydraulic slides, dowel presser



STEEL SHAFT ASSEMBLY FOR AUTOMATIC TRANSMISSION

At a gross rate of 210 parts an hour, eight vertical 3-spindle units on the center column operate on this shaft. To clear the stem of the work as it indexes, hydraulic slides raise these units 5.5 inches from their operating positions. The movement takes one second each way and has a smooth harmonic motion. Cams in the units feed the tools 2.7 to 3.5 inches more as required.

A dowel pressing unit is at the right. The operator loads dowels into the hopper at the top. Three dowels are fed down different tubes and are pressed into the work. At the previous station the work is washed clean of chips.

A 63-inch index table holds 12 work fixtures with power clamping and unclamping.

Real production without trouble. Production men praise our machines because they really produce and give little trouble. The main reasons are good basic design and rugged, accurate construction. If you have a job for a multi-unit automatic and can't afford to live with it day after day to make it work, consider a Kingsbury. It will pay off. Kingsbury Machine Tool Corp., Keene, New Hampshire.

KINGSBURY MULTI-UNIT AUTOMATICS

Kingsburys make money on simple jobs too

PUMP PULLEY FOR AUTOMATIC WASHER

This simple machine makes money for the Maytag Co. by producing at a gross rate of 590 parts per hour with almost no downtime or rejects.

A 15-inch index table holds four work fixtures with manual clamping and unclamping. Four horizontal units drill and tap two holes. Bushings guide the drills for accuracy.

Typical Kingsbury jobs in eleven industries

These parts are used in a ball bearing, automatic transmission, door set, engine, generator, air conditioner, electric shaver, valve, aircraft engine, control instrument and rifle. All cost less on Kingsburys.

20 Distributors

EAST	Hartford 7	O C Stevens Mchy Co
	Long Island City 1	Triplex Mach Tool Co
	Philadelphia 6	John S Wright Mchy
	Syracuse 1, Buffalo 23, Rochester 4, Schenectady	Syracuse Supply Co
MIDWEST	Cincinnati 2	E A Kinsey Co
	Chicago 51, Milwaukee 8	Four States Mchy Co
	Cleveland 3, Toledo 13	Golden & McCoy
	Dayton 2	C H Gosiger Mchy Co
	Detroit 19	Birmingham & Conner Mchy
	Grand Rapids 4	Joseph Monahan Co
	Indianapolis 20	C C Garrett Mchy
	Pittsburgh 37	Merit Mchy Co
	St. Louis 24, Kansas City, Mo., Wichita, Tulsa	Robert R Stephens Mchy Co
SOUTH	Atlanta 6	J R Walraven
	Charlotte 5	Geo A Marshall Mchy
WEST	Houston 13	Wessendorf Nelms & Co
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	Spokane 8	W R Matthews Mchy & Tool Co
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PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS— to help you

SUPERFINISH SAVES WALLINGFORD STEEL 1408 MINUTES PER PART

Setup saves $8,000 in grinding wheel costs

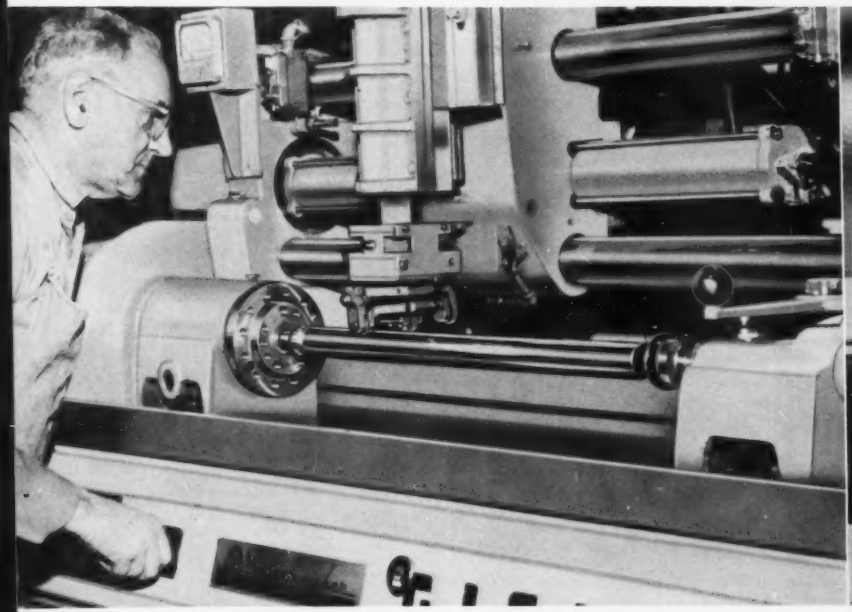
There isn't much to see in the illustrations—just the simplest kind of setup on a Gisholt MASTERLINE 52-A General-Purpose Superfinisher. But the savings that have been made for Wallingford Steel Company, Wallingford, Connecticut, are truly startling.

Wallingford Steel Company rolls stainless steel strip and special stainless alloys including tungsten, titanium and Stellite, used in the manufacture of cutlery, automobiles, etc. Solid carbide rolls are used to meet requirements for an ultra-smooth, highly reflective finished product.

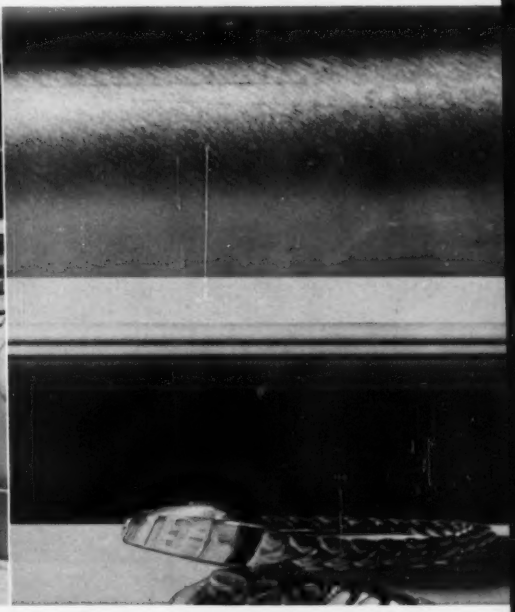
Previously, roughing and finishing rolls were ground using 600, 1500 and 2000 grit wheels, and then lapped to remove chatter and spiral feed marks left from grinding. Time, 80 minutes for grinding and 1440 minutes for four lapping passes taking six hours per pass. Total time, 1520 minutes.

Now the 52-A Superfinisher, equipped with a special high-speed oscillating head, a variable-speed drive and steady-rest support rolls, eliminates the entire lapping operation. In addition, only the 600 grit wheel is needed for rough grinding, reducing grinding time. This means an added initial saving of over $8000 because the costly 1500 and 2000 grit wheels are eliminated. Superfinish removes all chatter and feed spiral marks left from grinding. It provides a "controlled" surface finish of 8 micro-inches RMS on the roughing rolls and 1 micro-inch RMS on the finishing rolls. Time on the 29⅛" x 2½" roll shown is 32 minutes. After use, rolls are refinished, as required, in only 18 minutes. Even "built-up" material is removed.

Standard General-Purpose Superfinisher with special tooling saves 1408 minutes per roll. Steady-rest support rolls assure parallelism, .00050 concentricity. Inexpensive Superfinishing stones replace $8000 worth of special grinding wheels.



This simple setup on a low-cost general purpose machine saves 1408 minutes per part. Typical 29⅛" x 2½" solid carbide roll shown is Superfinished in only 32 minutes. Superfinished rolls produce same tonnage, operate at same mill speeds as lapped rolls previously used.



Roughing roll (top) Superfinished to 8 micro-inches RMS. Finishing roll (bottom) Superfinished to 1 micro-inch RMS. Note difference in reflectivity.

SETUP SPEEDS CRANKSHAFT BALANCING AT JOHN DEERE

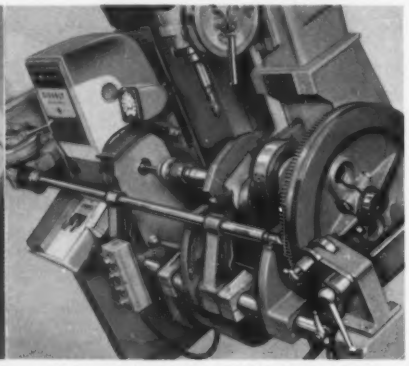
Unbalance measured, located, corrected, and inspected with one handling

Perhaps you can speed up your balancing operations by studying this setup used at the John Deere Waterloo Tractor Works, Waterloo, Iowa.

The workpiece is a John Deere 730 diesel tractor crankshaft, 21″ flywheel and counterweight assembly. A Gisholt 3S DYNETRIC Balancer is used with an end drive coupling to simplify handling. Two power drills mounted on the balancer, one vertical and one horizontal, correct unbalance by drilling at a 9″ radius in the 21″ flywheel and at a 6″ radius on the counterweight. A hand-operated thrust and centering device provides drilling support.

The operator assembles the crankshaft, flywheel and counterweight; places the assembly in the work supports; engages the end drive, and starts rotation. The direct reading amount meter is calibrated in terms of drill depth; so, the operator merely notes the angle and drill depth for each correction plane. Then he stops rotation. Unbalance is corrected in each plane by manually indexing the assembly to the observed angle and drilling to the exact depth shown on the amount meter. A simple calibrated dial on the drill feed handwheel assures accuracy. The assembly is rotated again for inspection. Unit numbers are stamped on each part; relative position markings are made, and the assembly is dismantled for storage. Total f.t.f. time, ten minutes —5.5 minutes of which is required for measuring, locating, correcting and inspecting for balance.

One 3S Balancer, requiring minimum floor space, combines all dynamic balancing operations. Here the operator corrects unbalance in left plane by drilling in counterweight using vertical drill spindle. Horizontal drill for correcting in flywheel, at left.



Close-up showing crankshaft, flywheel and counterweight assembly in 3S Balancer with end drive. Ten minutes f.t.f. time includes assembling, balancing, correcting, inspecting, dismantling and stamping of unit numbers, timing and location marks.

Direct reading amount meter, calibrated in terms of drill depth, speeds unbalance correction. Depth dial on drill feed handwheel assures accuracy. Setup cuts costs, saves time with all balancing operations completed in one handling.

HOW MASTER ELECTRIC CO. CUTS "OFF-CENTER" BORING COSTS

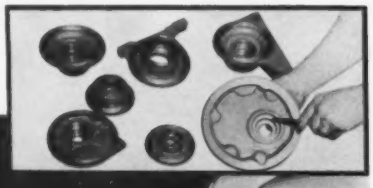
Sliding faceplate on Fastermatic automatic chucker combines operations

You will want to study this setup at Master Electric Company's Dayton, Ohio, plant. It combines "off-center" boring with standard turning and facing operations to eliminate extra handling and improve accuracy.

The workpiece, a cast iron gear cover, is held in a special faceplate fixture, chucking on a back hub and locating against a back face. With the part "on-center," tools on hex 1 turn the O.D. while front and rear cross-slide tools rough and finish-face. The cycle stops. The operator loosens a nut and grasps a handle (both encircled) on the faceplate fixture, pulling it "off-center" for the second phase. He tightens the nut and starts the automatic cycle. Other hex turret tools machine three different diameter bores. The two co-bores are relieved at the base, sized for depth and reamed. The intermediate co-bore is held to a 40 micro-inch RMS finish. F.t.f. time, 6.5 minutes.

Over 60 Fastermatics are in constant use at Master Electric Company's Dayton, Ohio, plant, completing over 150 motors per hour. They have proven ideal for efficient production of short-run, complex parts such as motor frames, gear covers, end bells, bearing housings, parallel heads, vapor-proof heads, etc.

One operator produces this variety of parts on the four machines he controls. Note gear cover at lower right. Operator indicates the three "off-center" diameters handled by sliding faceplate fixture.



After turning O.D. and facing part, cycle stops; operator loosens nut, grasps handle (both encircled) to move faceplate fixture over for "off-center" boring.

Fastermatic's automatic cycle permits one operator to handle four machines. Sliding faceplate fixture combines two operations in one chucking; assures accuracy, correct relationships between machined surfaces.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

SMART SETUP ELIMINATES OPERATION FOR DRAPER CORP.

Standard machining and threading combined on Simplimatic automatic chucker

This setup cuts handling costs, improves accuracy and clearly shows how the Simplimatic's wide platen table offers great flexibility in arranging independent slides to machine a maximum number of surfaces in a single chucking. Draper Corporation, Hopedale, Massachusetts, takes full advantage of this feature in machining various sizes of cast iron threaded beam heads for textile equipment.

On a typical 26″ diameter, narrow threaded beam head, work is held in a 32″, three-jaw air chuck, locating at X, gripping at Y. Table feed is used to turn the O.D.s, engage three front slide rough-facing tools and center slide boring tools with the work. Table feed stops when front slide facing tools are to proper depth, and standard slide movements begin. Front slide feeds away from center, with three tools dividing the rough-facing cut. Piloted boring bar tools on the center slide finish the bore. Rear slide operates separately to finish-face and round front and back O.D. edges. After the finish-facing cut, the two-speed motor changes to low speed, and a tap and chamfering tool on the center slide boring bar threads and chamfers the bore. The tap collapses; the table and slides retract; the tap is automatically recocked for the next operation. F.t.f. time, seven minutes.

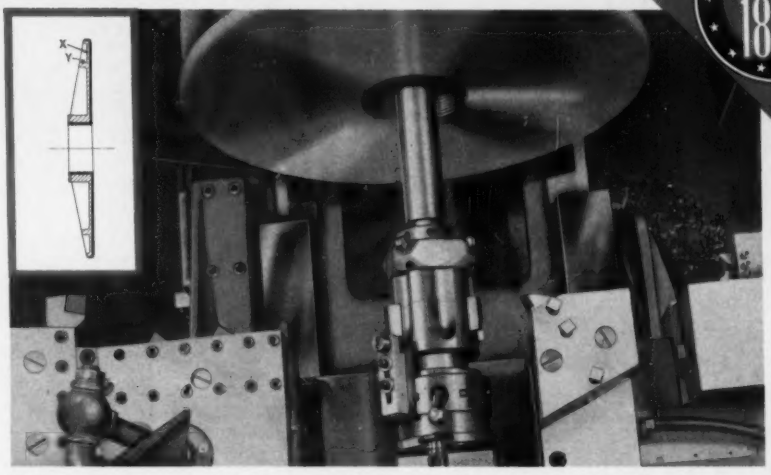


Photo shows tools retracting from work. Note how right combination of tools and slides on platen table permits standard machining and threading to be handled in one chucking.

Simplimatic's flat platen table cuts tooling costs, permits standard machining and threading on automatic chucker, saves extra operation. Two-speed motor provides correct surface speeds.

HOW CUTLER-HAMMER STEPS UP SMALL-PARTS PRODUCTION

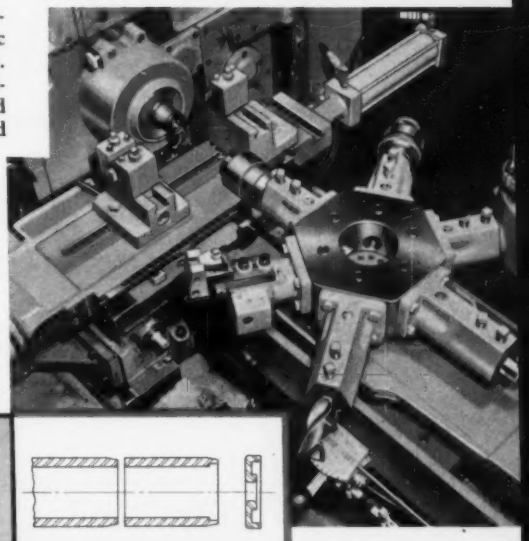
Hydraulic drive makes automatic chucker of ram type turret lathe

This setup at Cutler-Hammer, Inc., Milwaukee, Wis., shows how your costs can be cut on general machining work. Two typical jobs are covered, showing how a simple hydraulic drive control transforms a low-cost Gisholt No. 4 Ram Type Turret Lathe from a hand-operated machine into an automatic chucker.

The coil shield, shown at left, is made from 1¾″ tubing; stock remains inside collet chuck for support while hex turret tools bore and chamfer I.D. Then stock is advanced to hex turret stop and rechucked. O.D. of the next part is beveled from the cross slide front and finished part is cut off from the cross slide rear. F.t.f. time, .7 minutes.

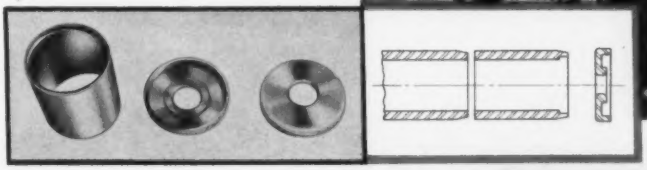
Cup washers, shown at right, are made from 2″ bar stock; stock feeds to hex turret stop, collet chucks on O.D. Front cross-slide tools form rear O.D. radius and face front (see drawing). Hex turret tools complete all other surfaces, including chamfer at back of bore handled by special slide tool. Finished part is cut off from rear of cross slide. Cycle repeats. Time f.t.f., 1.77 minutes.

Hydraulic drive controls turret ram and cross-slide tools, spindle start-stop-reverse, speed and feed selections, reverse feed, and automatic collet chuck and bar feed operation. Operator loads bar stock and initiates first cycle. He removes finished parts and has time to handle second machine.



Tooling for machining cup washers. Part made from 2″ bar stock with all 14 surfaces indicated on drawing handled in 1.77 minutes f.t.f.

Left—coil shield produced in .7 minutes f.t.f. from 1¾″ tubing; right—cup washer produced in 1.77 minutes f.t.f. from solid 2″ bar stock.



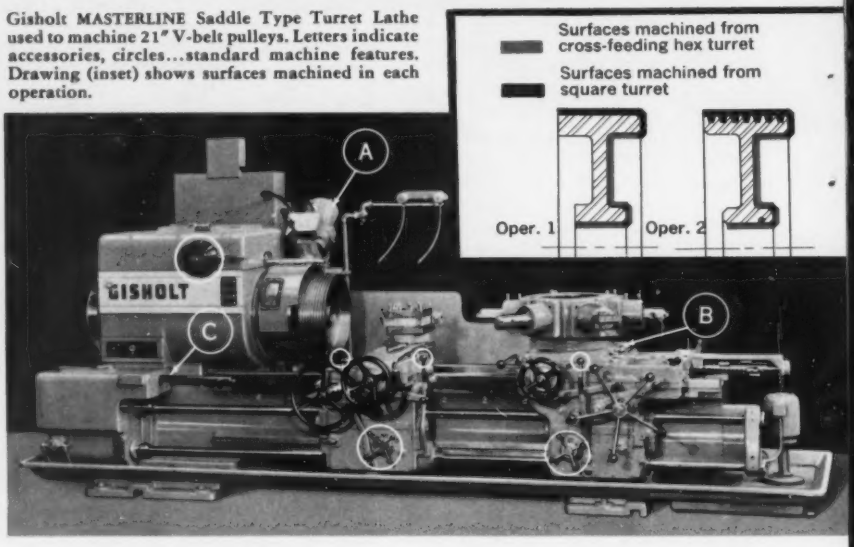
Operator productivity is greatly increased. Hydraulic drive provides low-cost automatic cycle, retains turret lathe flexibility for handling of wide variety of parts.

MACHINES WITH NEW MACHINE GUARANTEE

HOW MACHINE FEATURES CUT PULLEY COSTS

Special stop bar speeds grooving; cross-feeding turret saves tooling

Gisholt MASTERLINE Saddle Type Turret Lathe used to machine 21″ V-belt pulleys. Letters indicate accessories, circles...standard machine features. Drawing (inset) shows surfaces machined in each operation.



This setup shows how Gisholt MASTERLINE Saddle Type Turret Lathe features and accessories can cut costs on your job-lot work. The drawing at right shows how 21″ semi-steel V-belt pulleys are machined in two operations on a Gisholt 4L. Work is held in a 24″, three-jaw scroll chuck. Hex and square turret tools are used simultaneously on boring and turning cuts to save time. V-belt pulley grooves are single-tooled to eliminate distortion and to provide a finer finish. F.t.f. times: Operation 1—16.5 min.; Operation 2—23.2 min.

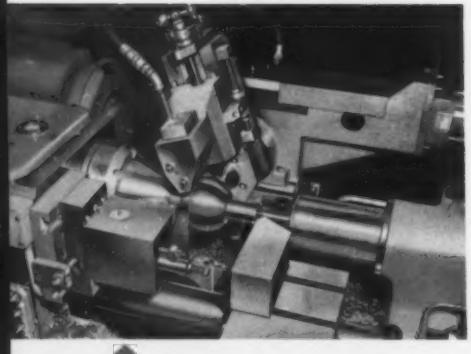
Here's how accessories cut costs: *Power Chuck Wrench* (A) adjustable chucking pressure minimizes distortion; reduces operator fatigue; assures quick, accurate chucking. *Cross-Feeding Hex Turret* (B) permits standard, lower cost tooling; handles straight boring, chamfering, cross-facing and recessing cuts that, on a fixed center machine, would require slide tools or special tools. *Special Stop Bar* (C) accurately spaced notches speed cross-slide carriage positioning for grooving.

Accessories plus standard Gisholt machine features (encircled) such as *Hydraulic Speed Selector* for fast *direct* or *pre-set* speed changes, direct-reading feed dials, separate rapid traverse levers for cross slide, cross-slide carriage and hex turret carriage—all add up to faster production, reduced costs, less operator fatigue on both simple or complex jobs.

Rugged construction, versatility, faster setup, simpler operation make Gisholt Heavy-Duty Saddle Type Turret Lathes particularly adaptable, and PREFERRED, for all types of heavy-duty turret lathe work.

ROCKWOOD SPRINKLER CUTS SPHERICAL TURNING TIME 50%

Spherical turning head, variable-speed motor save time, improve accuracy and finish



Spherical turning unit generates O.D. on wide range of parts. Tools on front carriage and headstock-mounted auxiliary slide finish-form both ends of bore, blending with spherical O.D.

Looking for a fast way to generate an accurate, smooth, spherical O.D. on stainless parts? Take a tip from the method Rockwood Sprinkler Company, Worcester, Massachusetts, uses for handling stainless valve ball forgings on a Gisholt No. 12 Automatic Chucking Lathe.

Special tooling includes a spherical generating unit mounted on the bed behind the spindle, a headstock-mounted front auxiliary slide and a variable-speed motor for uniform surface speeds on increasing and decreasing diameters. The generating head is positioned by hand with micrometer adjustment and adjustable positive stops for separate roughing and finishing tools.

The workpieces, previously bored on the same machine, are held on an expanding mandrel with tailstock support. The spherical generating head roughs the O.D. in three passes. On the fourth pass the finishing tool is used to provide a 90 micro-inch RMS finish and to hold the .002″ O.D. tolerance. During the finish cut, the front carriage feeds longitudinally, actuating the auxiliary slide, so that both ends are finish-formed at the same time. Time f.t.f. on the 6″ ball shown is 32 minutes.

Spherical turning method provides smoother finish, greater accuracy; simplifies machining. Seven different sizes handled with minimum change-over. Variable-speed motor provides constant surface speed, longer tool life.

Typical parts handled with this setup. Left to right: after boring; 6″ ball (16 pounds of stock removed in O.D. turning operation, 1⅜″ stock per side); 3″ ball (3 pounds, 8 ounces removed, 1⅛″ stock per side); 2″ ball (2 pounds, 6 ounces removed, 1¼″ stock per side).

No. 1-259
725

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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The *EASIEST, FASTEST and CHEAPEST WAY* TO SHARPEN A DIE is to... *PUT IT ON A BLANCHARD!*

The Blanchard method of die sharpening is unequalled for speed, safety and economy. All of the dies shown are sharpened on a Blanchard No. 18 Surface Grinder with equal ease.

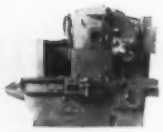
The rotary work motion of the Blanchard, with the wheel covering the entire surface at each revolution, enables the operator to remove the amount of stock to sharpen the die and no more! This saves time and increases the life of the die, too.

The ample supply of coolant and the ability to use free-cutting wheels permit high grinding speeds without danger of burning the work. This extra speed reduces idle time on the presses.

Many shops use their Blanchards for die sharpening as well as all other surface grinding required in their manufacturing. The 3 Blanchards shown below cover work requirements from finishing tiny gears to roughing steel plates 84" across corners.

Write today for your free copy of WORK DONE ON THE BLANCHARD, Fifth Edition and "the Art of Grinding", Fourth Edition.

No. 11



No. 18

BLANCHARD

THE BLANCHARD MACHINE COMPANY

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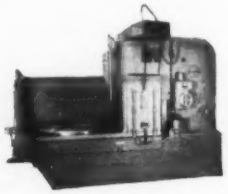

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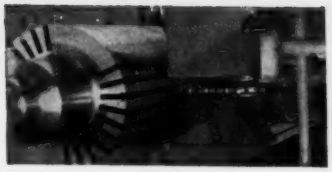

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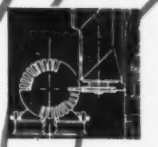
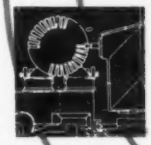
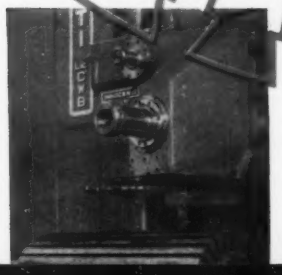


- CWB - BORING AND MILLING MACHINE



horizontal head
equipped with
finger-type milling cutter
for high speed
dovetail slots forming.
The head allows
a normal setting
of the machine
milling and boring
spindle
thus permitting also
flattening
and
milling operations
as for polygonal rotors.

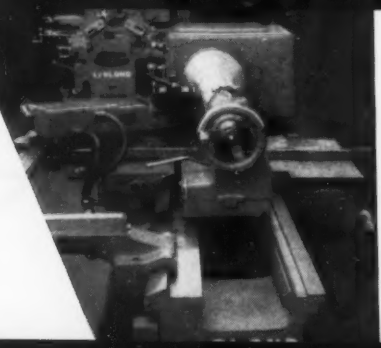


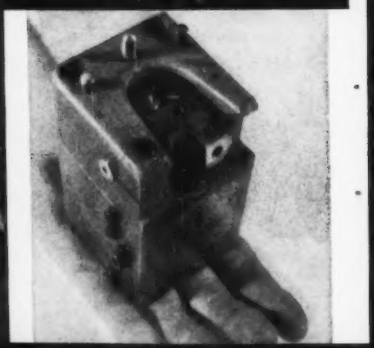
bertani F139

New Tracer? Yes!

SIMPLICITY ITSELF! All parts mount on lathe, need no extra floor space. Set-up takes less than 15 minutes. Short hoses are located out of operator's way.

LOCKED-CIRCUIT VALVE is secret of responsive operation. Precision plunger fits to .0001". Valve maintains constant accuracy, does not heat up in operation.





All new* from LeBlond

REGAL-TRACE

**New principle, new design, new convenience, new price—as low as $2760!*

Now, a completely new tracer unit designed exclusively for famous LeBlond Regals and Dual Drives. Regal-Trace! Engineered from the start for convenience, compactness, responsiveness, precision and economy. LeBlond quality throughout – and new low prices beginning at $2760 (for 13" Regal model).

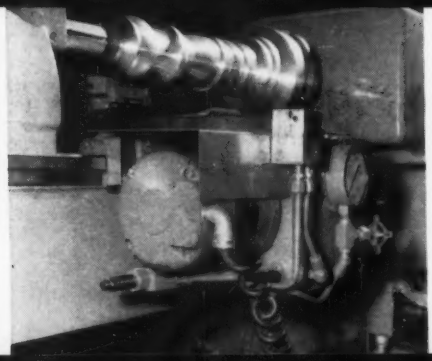
Easy to use – Traces radii, stepped shafts, contour faces, tapers, compound and spherical curves. Swivels 45° either side of perpendicular to the work. Cuts toward or away from headstock. Uses easily prepared flat templates.

Self-Contained – Only 4 major parts: tracer unit, power unit, template carrier and bed bracket assembly. All parts, including compact hydraulic system mount on lathe. No extra floor space required. Tracer unit replaces compound rest, can be installed and operating (or removed) in less than 15 minutes. No reduction whatever in swing capacity. Permanently rear-mounted hydraulic unit becomes integral part of machine, does not interfere with normal lathe operation.

Accurate, smooth, fast – Locked-circuit hydraulic system delivers a new degree or responsiveness and precision. Stylus pressure less than one pound. Will consistently reproduce parts to accuracy of ± .0005". Pressure is maintained at 300 psi (or higher if desired). Hydraulic cylinder provides feed rate of 75 in. per minute. Unique valve unit is preset at factory, requires no adjustment.

Fits any LeBlond Regal built since 1955 and all Dual Drives. Can be installed in the field or purchased as original equipment on new lathes. Write today for complete information and specifications on the all-new LeBlond Regal-Trace or see your LeBlond Distributor.

COMPACT HYDRAULIC UNIT mounts permanently at rear, does not interfere with normal lathe operation. Includes oil reservoir, pump, motor, relief valve.



EASILY PREPARED flat templates mount conveniently at front of lathe, are easily stored between jobs. Straight template or straight edge used for turning tapers.

LeBLOND of Cincinnati

...cut with confidence

The R. K. LeBlond Machine Tool Co.

Cincinnati 8, Ohio

World's Largest Builder of a Complete Line of Lathes for More Than 72 Years

NEW FROM FAIR STREET • HOME OF THE JIGMIL

mic

the first grinder

"Micropoint is the first machine in its field able to grind tool profiles geometrically correct to gage room accuracy"

"MICROPOINT is not just another grinder. It's a precision machine that makes possible a new technique of single point tool grinding. Advantages of this new technique include greater cutting tool life, increased accuracy and output of machine tools and greatly improved uniformity and finish of the end product. Originally developed for our own use, MICROPOINT became necessary in our continuing pursuit of accuracy."

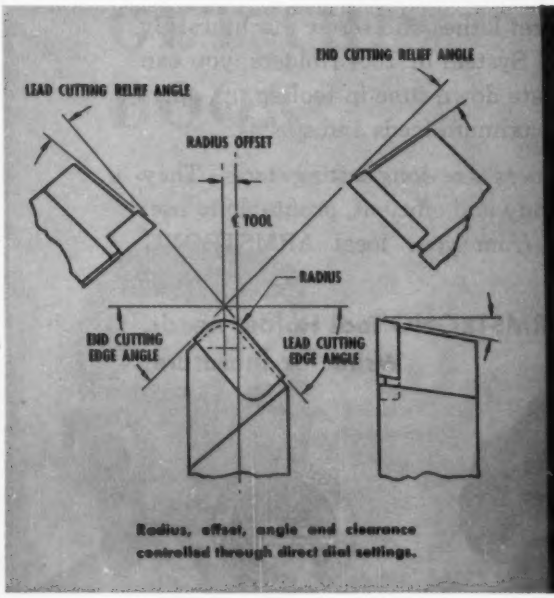
C. B. DE VLIEG

DE VLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

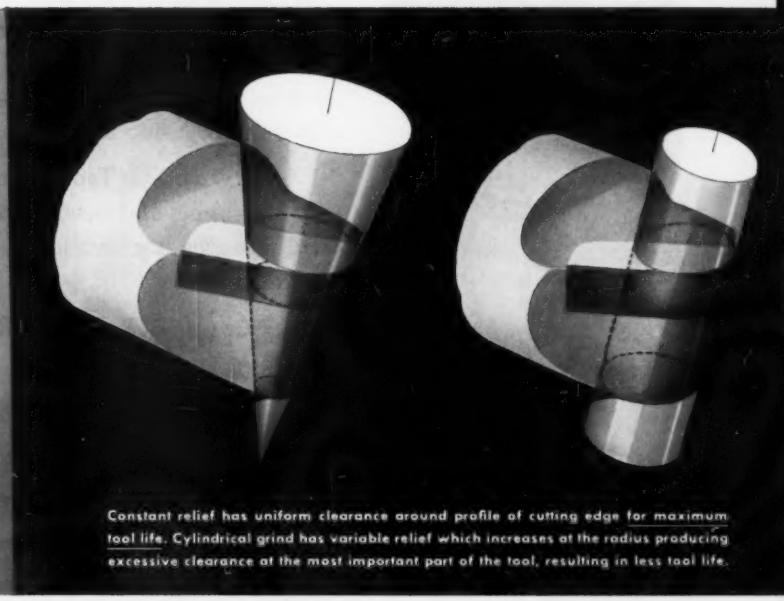
For more data, circle this page number on inquiry card

ropoint®

capable of absolute control of tool geometry



Radius, offset, angle and clearance controlled through direct dial settings.



Constant relief has uniform clearance around profile of cutting edge for maximum tool life. Cylindrical grind has variable relief which increases at the radius producing excessive clearance at the most important part of the tool, resulting in less tool life.

DIRECT DIAL SETTINGS reduce the possibility of human error and provide a method of fast, simple, accurate adjustment for each radius, angle, offset and clearance in exact accordance with the geometric requirements of the tool. With a minimum of operator training, tool profiles can be controlled to .0001". Set-ups can be made quickly and with precise accuracy. Operators have ground as many as 300 identical tools in one set-up without corrective adjustment. Because of the machine's unique design, diamond wheel cutting life has been increased 4 to 6 times. Field tested for three years, many MICROPOINT grinders are already in use throughout industry. Available from your DeVlieg distributor.

Write for Micropoint Tool Grinder Catalog

REWARDING REVELATIONS IN PRECISION
AWAIT YOUR VISIT TO FAIR STREET

DeVlieg

MICROPOINT® TOOL GRINDER

Geometrically correct tool points ground to gage room accuracy!

ARMSTRONG

TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.
Write for literature.

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

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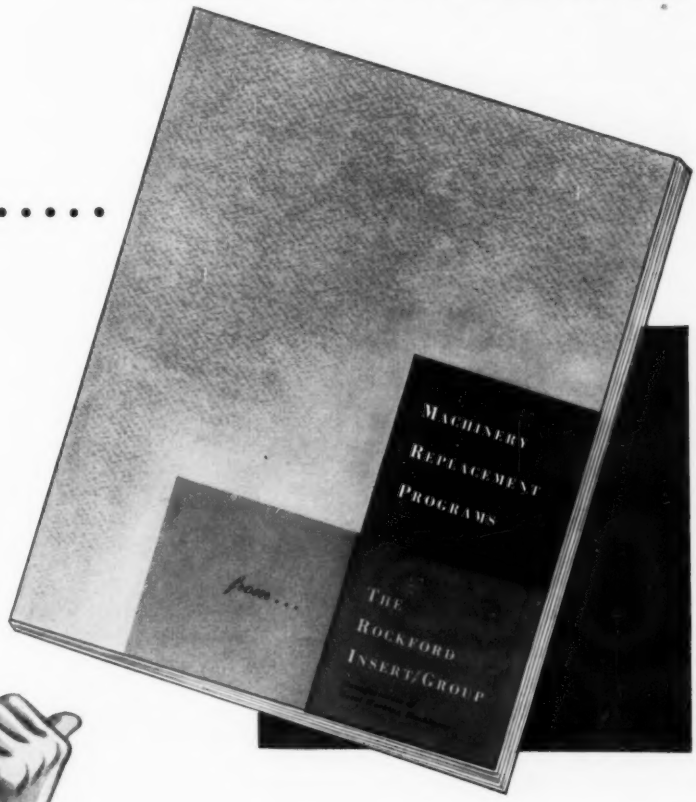
if you are responsible for machinery and equipment buying

GET THIS BOOK

Eighteen prominent industrialists discuss their machinery and replacement programs in this book. This valuable information represents the most up-to-date collection of evidence of the importance of such programs in industry today. For your free copy, merely write to any one of the companies in the Rockford Insert Group.

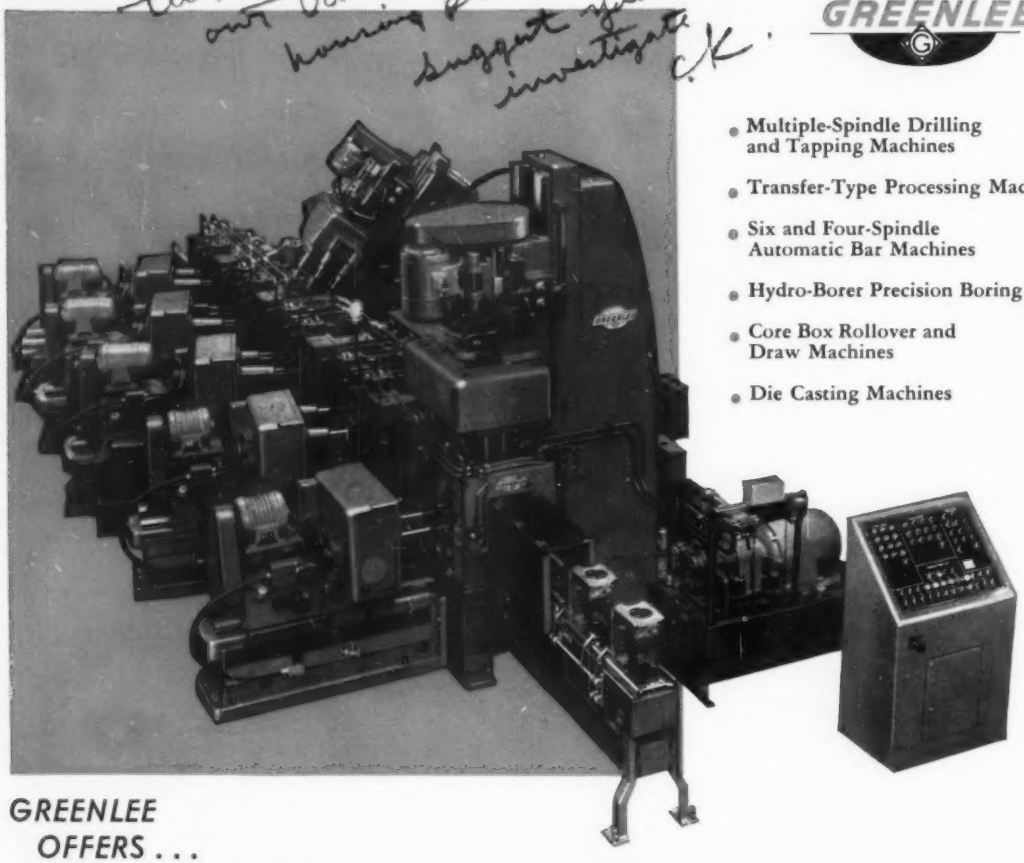


Rockford Insert Group

Keep gathering metal working production ideas . . . be well informed when you replace machinery

February, 1959

Sam:
this may solve
our transmission
housing problems.
Suggest you
investigate
C.K.



- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines
- Core Box Rollover and Draw Machines
- Die Casting Machines

GREENLEE OFFERS . . .

COOPERATION FOR AUTOMATIC PRODUCTION

The emphasis is on cooperation at Greenlee. Your ideas are added to Greenlee's. One idea sparks another. The result . . . the creation of machines that will meet your requirements efficiently . . . economically . . . now and in the future. Top-flight Greenlee engineers help you avoid costly mistakes. Their thinking is sound . . . respected. Call Greenlee. Let them give you the complete story on cooperation for automatic production.

MACHINES DESIGNED WITH THE FUTURE IN MIND

GREENLEE BROS. & CO.

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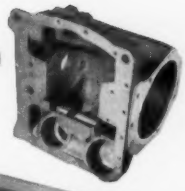
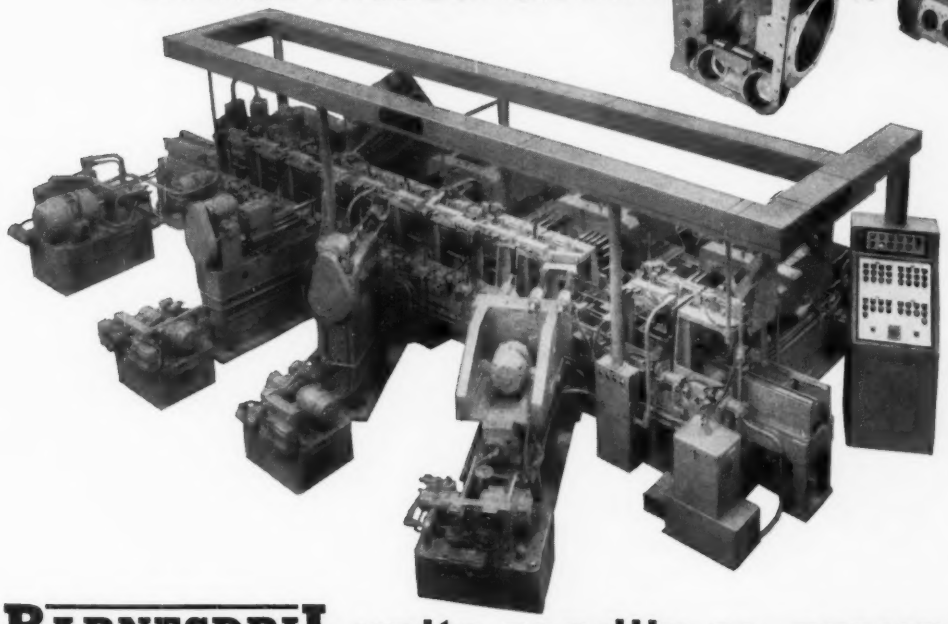
ROCKFORD, ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

CHANGE PRODUCTION from  to

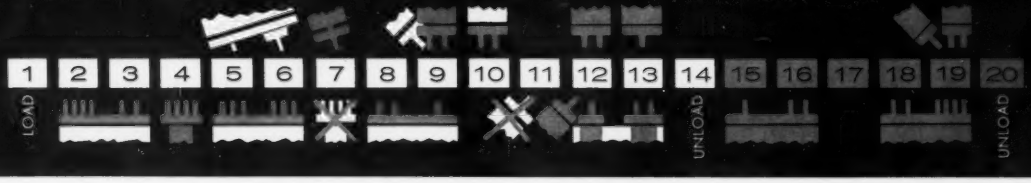


BARNESDRIL units readily re-group or modify for new production needs

Here's how existing machines may be changed to handle new production problems.

- Modify auxiliary heads on existing machines.
- Use existing center section, modify or add new units.
- Adapt new center section, modify and/or add new units.
- Use idle equipment and group around existing or new center section.
- Use existing units, move from facility to facility, and adapt to required production.

Diagram shows BarnesdriL transfer machine as modified, original machine in white, with changes and additions in gray.



BarnesdriL engineers have been building production unit-type machines since 1937. Many of these original machines have been re-grouped or modified several times, effecting tax savings and reducing capital investment requirements. If you have product changes at the present time, or want to change-over to new operations, ask BarnesdriL engineers to show you how existing machines can be effectively utilized, with savings up to 20% over new machinery costs.

New Bulletin

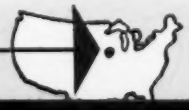
Contains Complete Story On BarnesdriL Units. Write For Free Copy.

HOLE BARNESDRIL FINISHING

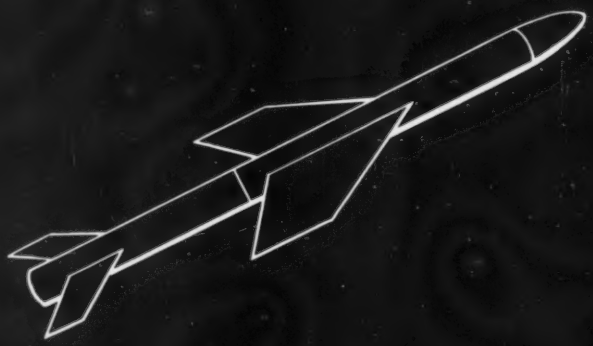
BARNES DRILL CO.

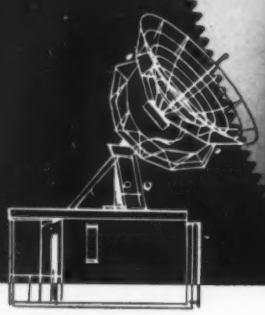
880 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

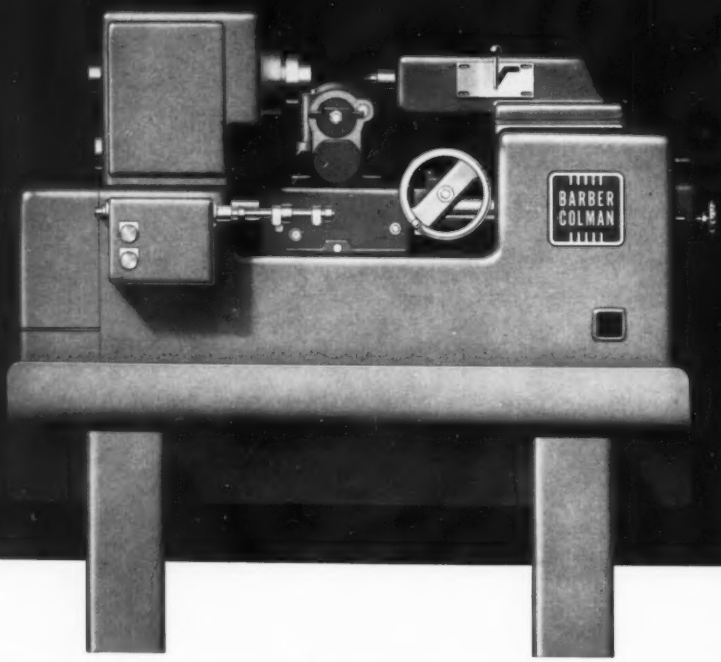
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



designed for...







Machinery, February, 1959

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

. . . precision instrument gears

new Barber-Colman hobber guaranteed to index accurately within 20 seconds of arc

Barber-Colman engineers have developed a new hobbing machine which guarantees indexing accuracy suited to gears used for aircraft, missile and radar guidance systems. This machine is known as the No. 2½ - 4 hobbing machine and hobs precision spur gears up to 2½" diameter x 2¼" face width, 30 D.P. in steel and 20 D.P. in brass. It provides accuracy, capacity and rigidity for precision fine-pitch work within a nominal price range.

One of the most important features of the new No. 2½ - 4 hobbing machine is the accuracy of relative rotation between the work spindle and the hob spindle which is guaranteed within 20 seconds of arc. This means that the spacing error on the gear caused by the indexing error of the machine would not exceed .00014" on a 2½" diameter gear.

The machine has a capacity for using 3" diameter hobs providing for a greater number of flutes to produce smooth gear tooth profiles. Using proper care in rigid tooling, accurate blanks, mounting of hob and work, and Class AA hobs with accurate sharpening, precision gears to Class 3 tolerances are hobbed with this machine.

Several design features are a departure from standard hobbing machine construction. There is no hob slide — only a hob carriage for conventional feed. In place of a hob slide, the hob arbor is mounted on a swivel which adjusts to compensate for hob thread angle. The work slide is stationary, and the hob swivel raises and lowers to meet diameter requirements. The machine has no overarm support, permitting greater work visibility and operator access. Both work and hob spindles are mounted in precision anti-friction bearings to provide accurate rotation at high speeds. The hob carriage also has anti-friction way supports, and the metal-to-metal contact afforded provides more rigidity than obtained with gib-type mounting An infinite number of hob speeds are provided without change gears in the range of 200 to 1200 r.p.m.

Rigidly constructed, with a steel weldment base and heavy grey iron machine bed, the machine is designed with a minimum number of parts at points where deflection and inaccuracies may occur. Net machine weight without tooling is approximately 1500 lbs. Standard equipment includes motor and controls and one set of change gears.

For complete specifications and data contact your nearest Barber-Colman representative, or write directly to the factory for a copy of new bulletin F-8642.

BARBER-COLMAN COMPANY

122 ROCK STREET • ROCKFORD, ILLINOIS

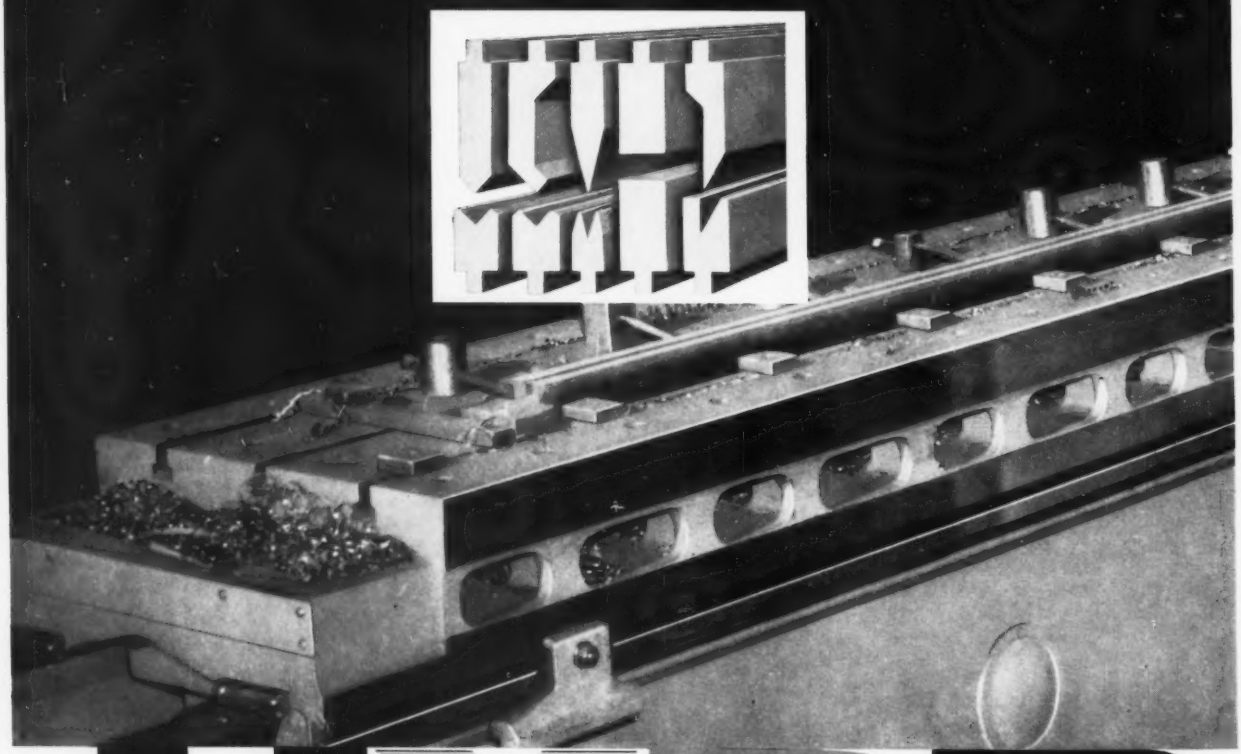
Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

ROCKFORD MACHINE TOOL CO. 2500 KISHWAUKEE STREET ROCKFORD, ILLINOIS

SPEED and VERSATILITY
of
Rockford Hy-Draulic Shaper-Planers
provide
"Off-The-Shelf Delivery"
for
DREIS & KRUMP
CHICAGO PRESS BRAKE DIES



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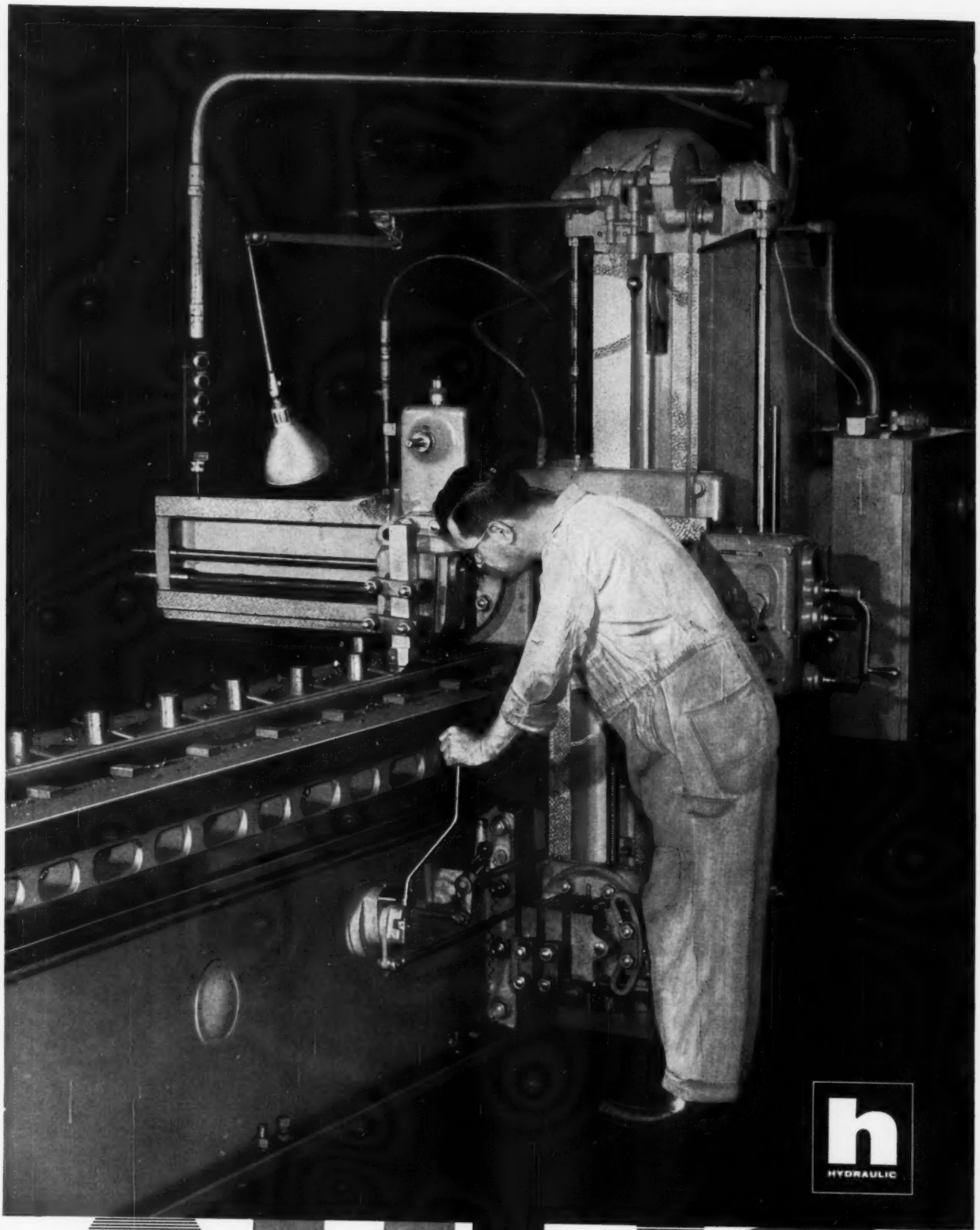
Machinery, February, 1959

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

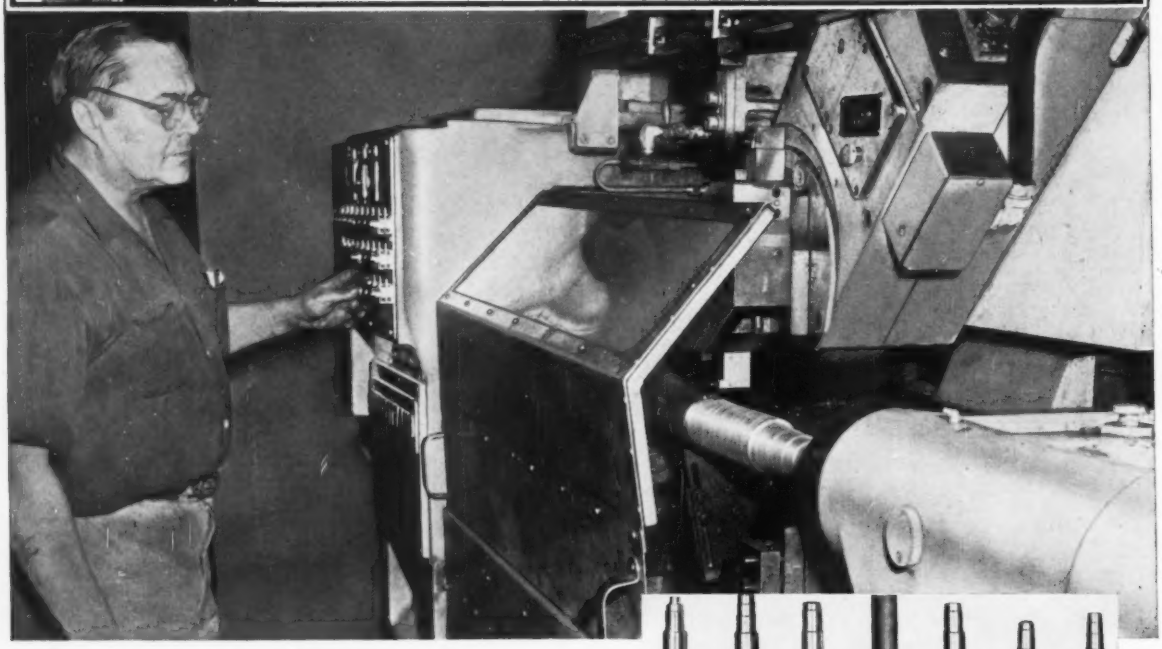


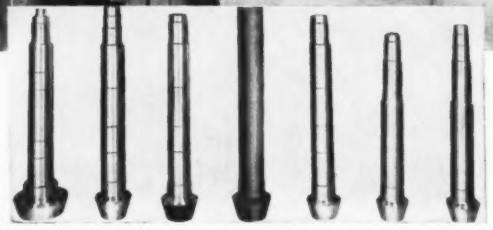
AULIC

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

SUNDSTRAND

"ENGINEERED PRODUCTION" NEWS





Tracer Turning of Bevel Pinion Shafts

Slashes Setup Time, Cuts Costs, Improves Finish

A combination of faster setups and reduced machining times enables one Sundstrand automatic tracer lathe to replace two machines formerly required for turning five sizes of tractor bevel pinion shafts. Increased production, reduced set up time, closer tolerances, simplified operation, reduced costs, and finer finishes are the benefits of this change to Sundstrand.

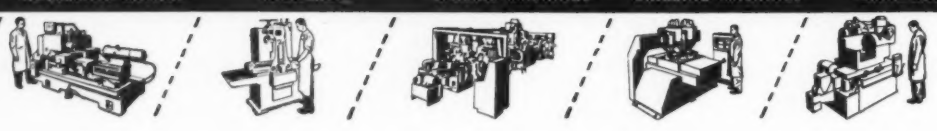
Changeover time was reduced from an average of 8 hours to 1 hour on the multiple small lots turned on this lathe. Rough forgings are ruff and finish turned in one set up using an automatic indexing tool turret equipped with a ruff and finishing tool. Finishes were improved 50% over previous machining method and tolerances are consistently held within the specified limits to eliminate rework.

Parts are loaded manually and clamped with an air operated chuck and tail-stock. Completely automatic operation is push-button actuated and the machine can be set up to provide up to four cutting cycles.

Chip disposal doesn't present any problem despite a high rate of metal removal because the machine has a large open chip chute and is equipped with automatic chip disposal.

AUTOMATIC LATHES | RIGIDMILS | SPECIAL MACHINES | DRILLING MACHINES | GRINDERS

SUNDSTRAND



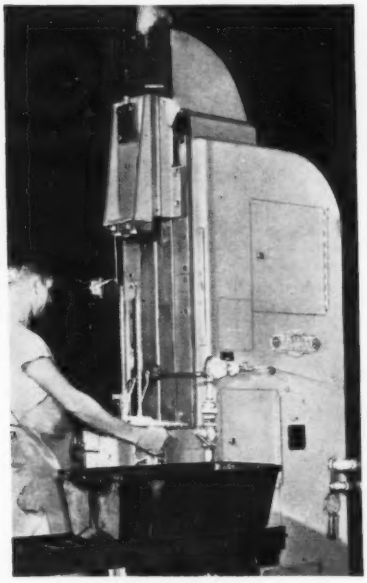
Machinery, February, 1959

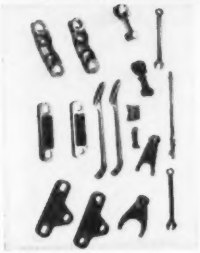
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Versatility and Dependability Keynote Broach Performance

More than 15 types of automotive, mining, industrial, and electrical equipment parts are broached on four American Broach machines at this Midwestern forging plant. Quick changeover and long broach life are as important as precision in making this a highly successful installation.

Properly designed broaching tools permit part tolerances to be maintained during long production runs with minimum resharpening. This partnership between tools and machines — adding the right fixturing where required — is the only sure way to provide top performance on every broaching job.





American three-way machine can be used for push, pull or surface broaching.

Typical parts broached by one customer on Sundstrand - American machines.

Tape-controlled positioning table permits precision hole drilling on two parts at a time.

Tape Control Simplifies Multiple Hole Drilling

Precision doesn't have to be expensive — this fact is proved by applying Sundstrand "Engineered Production" to this multiple hole drilling job. The special drilling machine is designed around Sundstrand's Jigmatic tape-controlled positioning table and uses drilling heads with minimum center distance requirements.

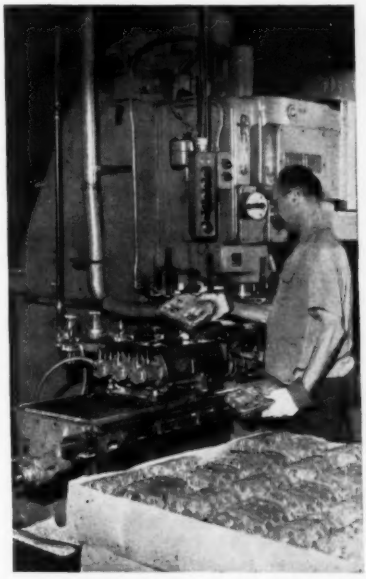
Two parts are drilled at a time without requiring expensive fixturing, lengthy setup times, or special operator skills. All the operator does is load and unload parts while the punched tape and electronically controlled table handle the actual drilling operations.

Considerable flexibility is inherent in the design. Other parts of similar size can be drilled by merely changing tapes. In addition, drill heads can be repositioned readily.

Rigidmil Triples Production on Close Tolerance Job

Tripling production per eight-hour shift — from 365 cylinder heads formerly to 1125 now — is the record of this Sundstrand Rigidmil. Not only is production of the aluminum alloy parts increased substantially, but also the parts are machined to a .0002-inch tolerance.

Extreme simplicity of operation, ability to load one part while another is milled, and exceptional machine rigidity all play equally important parts in attaining production records like this one. Sundstrand builds an extremely broad range of standard machines and backs them up further with semi-standards and specials, where required. This complete line, together with Sundstrand's unmatched production milling experience, is your assurance of getting the best milling machine for the job.



Two workholders with hydraulic clamping permit loading one part while another is being machined.

Additional Information on the broad line of Sundstrand machine tools is available in Bulletin 600. Write for free copy today.

BROACHING TOOLS BROACHING MACHINES PRESSES

SUNDSTRAND
MACHINE TOOL CO.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

New Quick-Tilt© spindle can increase your grinder production 50% PATENT PENDING

Converts from roughing to finishing in seconds

Until now, users of vertical-spindle surface grinders have had to compromise either accuracy or production because of the difficulty in tilting the wheel spindle. In fact, to combine high stock removal with fine finish and flatness meant paying for two operations instead of one.

Now it is possible to tilt the spindle by just turning a selector switch. You have power-tilting to eliminate wheel drag when roughing, yet in a matter of seconds the grinding wheel can be reset to the flat position for finish grinding.

Simple, isn't it? You might even ask: "Why didn't you think of this ten years ago?" Actually, the real significance of this feature lies in the new thinking about surface grinding as a stock removal operation. Ten years ago grinding was considered a finishing process. Therefore, it was not until we had proved the direct and indirect cost savings made possible by grinding from the rough that the need for power-tilting spindles became imperative.

Production tests in our Methods Laboratory show that the average grinding operation can be at least 50% more efficient—that's comparing one machine with the wheel set flat against one on which the cycle is divided between roughing and finishing. But, the profit significance of power-tilting shows up more dramatically when *grinding* through outer scale and burned edges instead of milling or planing.

How to increase stock removal

With a tilted spindle your motor horsepower is applied over a smaller wheel area for greater grain penetration. This produces a bigger chip. You can use harder wheels and still get breakdown.

Fig. 1—Turning the selector switch automatically tilts the spindle .010 in. toward the leading edge, or back to dead flat.

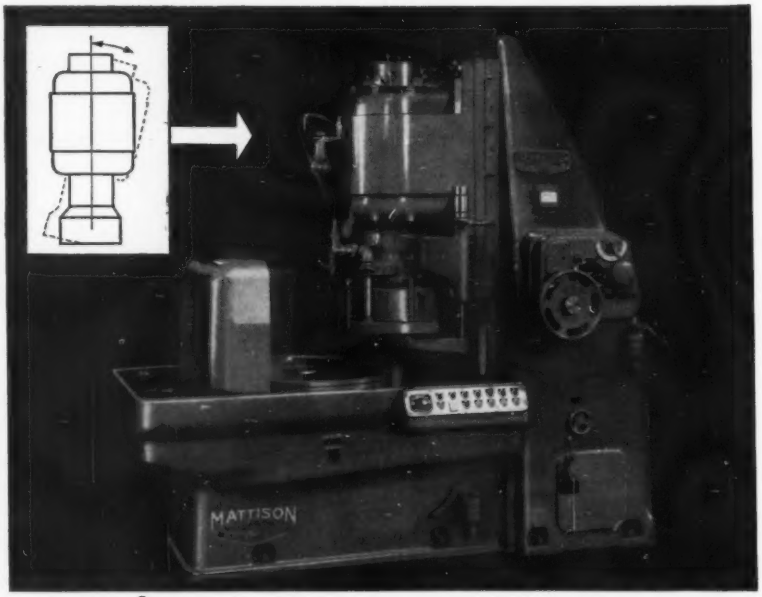


Fig. 2—Quick-Tilt© spindles solidify all the accuracy and stock removal features built into Mattison No. 24 and 36 rotaries. These machines are being built with spindle motors up to 60 hp to provide optimum cutting speeds on stock-removal operations.

With modern casting and forging techniques, there is no reason why stock allowances should not be specified for rough grinding of flat surfaces. This means a saving of approximately 50% of the stock allowance normally required for tool or cutter finishing. If close tolerances or finish are requirements, think of the dual advantages by grinding.

Hard spots, scale, and burned edges are no problem. We can show you examples of savings on parts such as bolster plates, forging dies, pump castings, and forged steel chain links.

Increases accuracy of small parts

With the practical elimination of curvature during the finish grind, more small parts can be ground per table load and setups can be speeded because the work need not be centered in relation to the wheel "ellipse." You use the same, easily adjusted clearance for every job. Leave enough stock for finishing and it is possible to grind over the full diameter of the wheel and still hold precision tolerances on all parts whether they're located at the outer edge or under the low point.

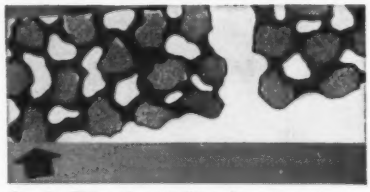


Fig. 3—Tilting the spindle reduces contact area between segments and work, permits use of higher horsepower and harder wheels. Slight bevel at leading edge reduces contact area for finishing.

See a demonstration

We are producing perfect diamond finishes on parts having large, uninterrupted surfaces. We can show you production savings, wheel life, and accuracy on test jobs or your own. Your Mattison dealer will make all the arrangements.

MATTISON MACHINE WORKS
Rockford, Illinois Phone 2-5521

Want more information? Send for new catalog describing Quick-Tilt spindle and other exclusive features of Mattison's Nos. 24 and 36 Vertical Rotarys.

MATTISON MACHINE WORKS

HIGH-POWERED PRECISION SURFACE GRINDERS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Huge Face Mill...

- *two Wesson cutters remove aluminum chips at rate of one ton in four minutes*
- *driven by 1000-hp motors*

...scalps at 11,800 sfpm

Demand for aluminum foil has increased so rapidly that producers have not had a chance to catch up with their production problems. One of the bigger foil producers decided there never would be enough time to catch up and gave one big problem to the Consolidated Machine Tool Div., Farrel-Birmingham Co., Inc.

The Problem

Before aluminum is cold-rolled into foil, billets weighing up to seven tons have to be face milled on both sides to remove scale and imperfections. Conventional equipment can mill only one side at a time, the billet being flip-flopped between cuts. This is costly. A scratch in a finished surface can ruin a mile of foil. Other problems are: slow metal removal; cutter grinding and setup take too long.

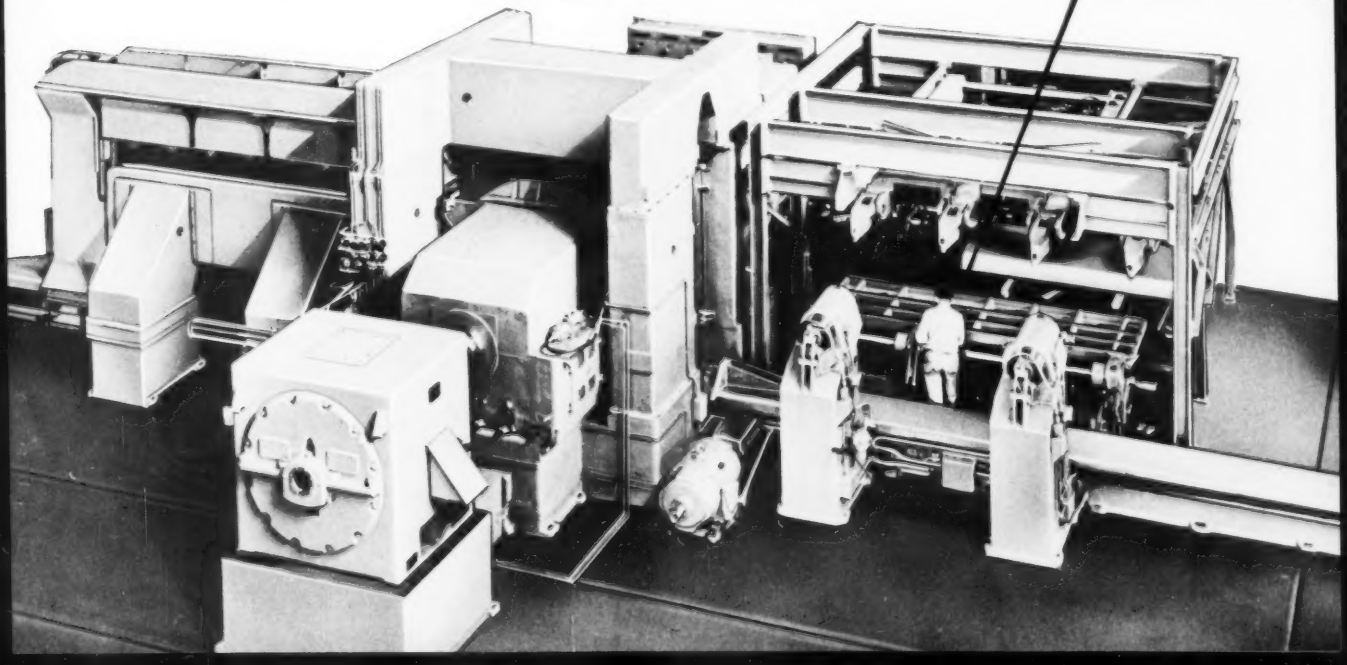
The Solution

A new machine to face both sides of the billet at the same time, eliminate flip-flopping and apply 1000 hp to each of two huge cutters. Now needed was a new cutter design. For this phase of the project, they called in Gerry Bogner, one of Wesson Company's top milling-cutter engineers.

The Cutter

Under Bogner's direction, Wesson engineers, too, departed from regular methods in the cutter design. Major objectives were high strength (cuts of ⅝ inch at feeds up to 360 ipm), ease of grinding and ease of setup. Investigation showed the last two requirements to be tied together. The solution was to insert Wessonmetal blades in standardized magazines that can be removed from the cutter body. Setup and grinding angles are machined on the magazines, minimizing grinding and setup time (see next page). Required strength was achieved by a combination of good materials, design and workmanship.

(*continued on next page*



TOOL NEWS carbide

Huge Milling Cutter

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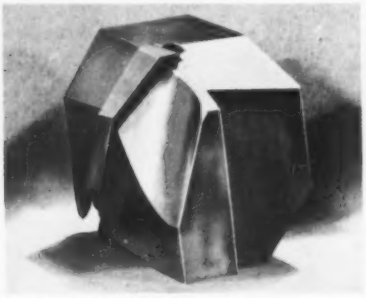
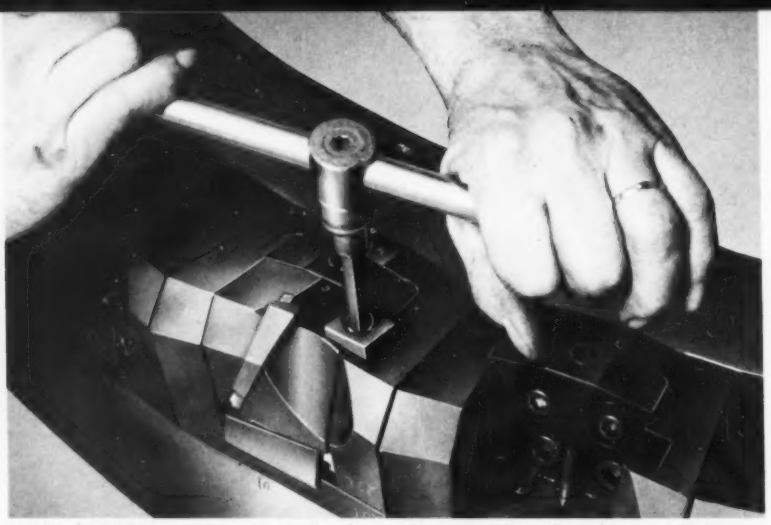
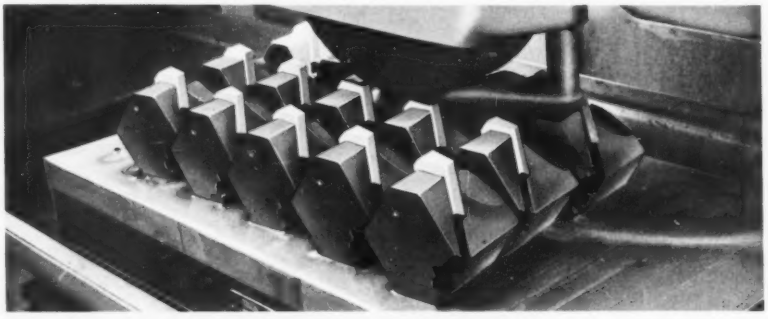


BLADE MAGAZINES themselves act as grinding fixtures through an intricate combination of machined compound angular surfaces which also provide the necessary clearance, and axial and radial rake angles. Magazines are completely interchangeable.



WHEN INSERTED in the cutter body, the magazines automatically preset all cutting edges without any need for gaging or indicating for runout. Each magazine is held in place, against adjustable wedges in the blocks, by a single wedge that exerts locking forces simultaneously in three directions. Tightening the bolt draws the wedge into position to securely hold the magazine. When the bolt is loosened, the wedge is forced out of its slot to free magazine. TIME FACTOR—45 minutes vs. the former 15 hours for setup.



MAGNETIC CHUCK of ordinary surface grinder holds several magazines with the Wessonmetal blades in place. Because proper angles are machined on the magazines, sharpening of compound angles on the blades is no problem. Grinding is continued until all blades of setup are sharp. TIME FACTOR—2 hours vs. the former 100 hours.

Keeping Up to Date?

Some keen tool designers knew that throw-aways on boring tools could minimize maintenance problems while letting them design the one best tool for the job. The result—special micro-adjustable tools like those at the right.

With this one idea, the job is half done. With the suggestions in

Bulletin #MB-157

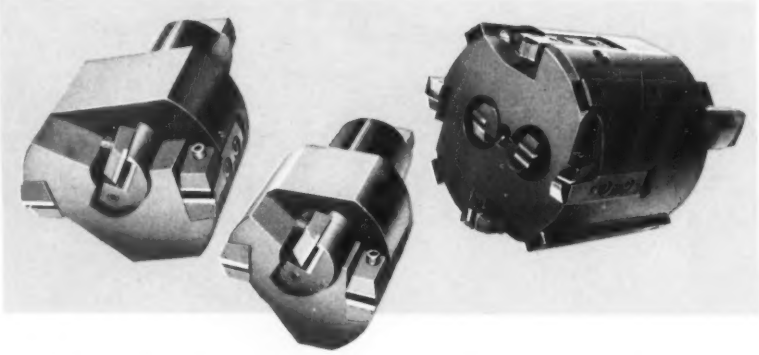
your job may be all done! This bulletin is continually updated so request it again if you haven't seen a recent copy.

tools Wesson carbide Wessonmetal

WESSON COMPANY, DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.

IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 Judge Road, Toronto 18, Ontario

Special Boring Quills Use Throw-Away Inserts

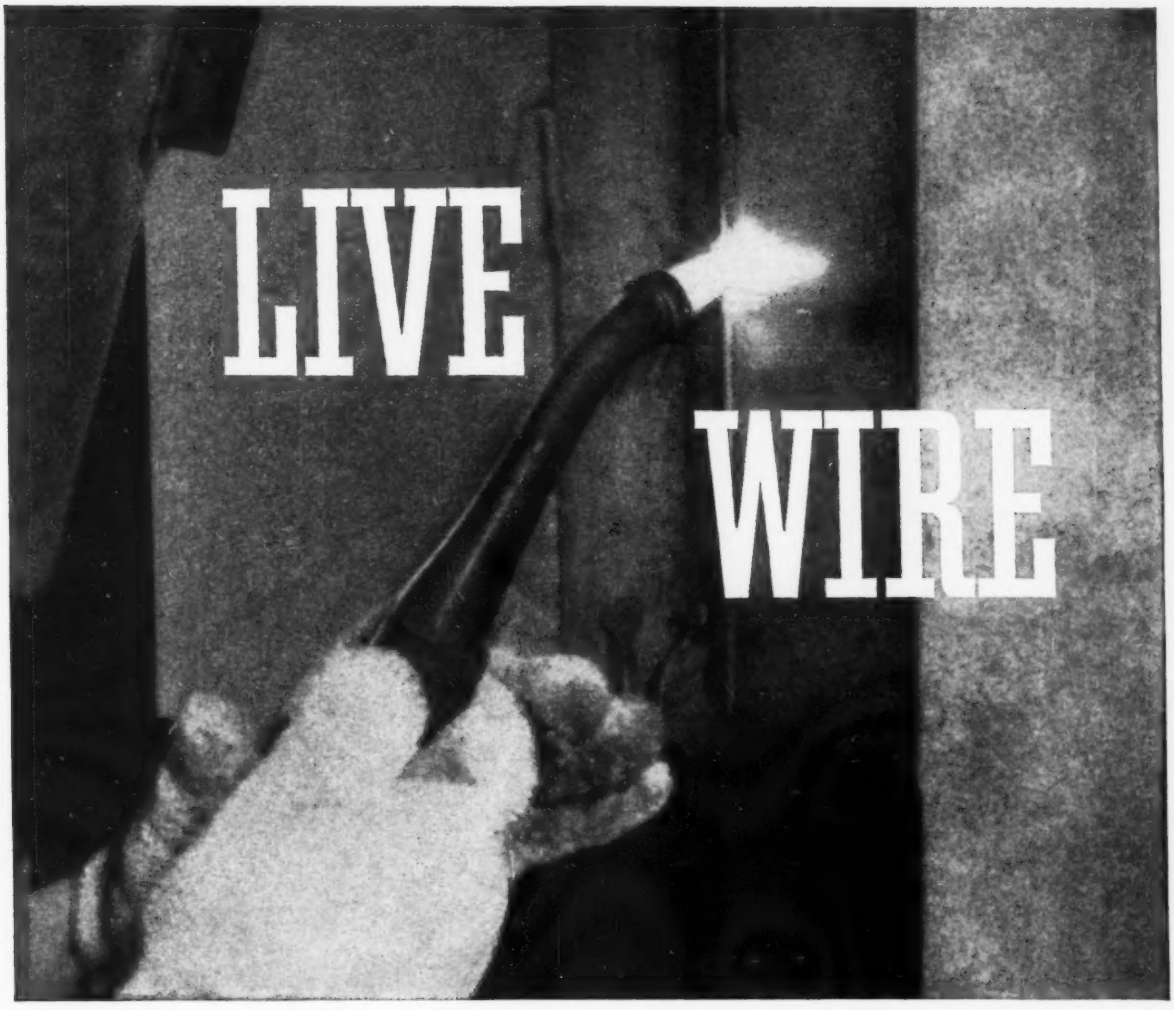


All of the outside-cutting inserts used on these three special boring quills can be adjusted radially and axially. For the two left-hand quills, this means that boring and facing cuts can be made within close tolerances—*for each cut and with relationship to each other*. Position of the spot-facing cutter is not critical in this tool.

The quill at the right is designed to perform four operations on *two different parts*. The operations are: bore, counterbore and turn two outside diameters. Different parts are machined by interchanging individual toolholders with the correct size inserts.

Use of throw-away inserts has made practical the correct design for these tools. *Optimum design* did not have to be compromised to allow for easy grinding and maintenance.

Litho in U.S.A.



New design in Sigma hand welding torches

Here is a new, lightweight torch—only 16 ounces—for manually welding light-gage steels. Sigma ST-2 welds in all positions with no change in control or current settings. Welds .030- to .100-in. sheet, using low-voltage short-arc technique with .020- and .030-in. hard-drawn wire. For 200 amp continuous service.

Balanced design makes handling easy. Service lines enter through rear of handle—a convenience in cramped quarters. Start-stop switch on handle, easy to reach. Nozzle has a 60° curve for maximum weld visibility.

Sigma ST-2 makes high-quality welds at high speed. Seams require no cleaning . . . distortion is at a minimum. Inert gas shielding is economical. Low flow rate—only 10 cu. ft. or less per hour—means even more savings.

Call your nearest LINDE office today for a demonstration of this new Sigma ST-2 torch! Or write Dept. MY-2, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Linde TRADE-MARK UNION CARBIDE

"Linde" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

For more data, circle this page number on inquiry card

Color micrograph of heat tinted section of ferritic Malleable iron showing random dispersion of temper carbon nodules in ferrite. 625X magnification.

Usability is Malleable

In the growing world of metals, certain requirements remain basic: strength . . . versatility . . . economy. Malleable iron castings uniquely answer all three. Malleable castings provide more strength per dollar than any other metal . . . are the most machinable of all ferrous metals of similar hardness.

From the great range of Malleable irons now produced in modern Malleable foundries, you can select exactly the right metal to fill your most demanding needs for endurance, resistance to impact and wear, ductility and constant uniformity. No other metal offers you so much at so low a cost.

For information or service, call on one of the progressive firms that identify themselves with this symbol—

MEMBER
MALLEABLE
CASTINGS COUNCIL

If you wish, you may inquire direct to the Malleable Castings Council, 1800 Union Commerce Building, Cleveland 14, Ohio, for information.

These companies are members of the

MALLEABLE CASTINGS COUNCIL

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck
New Haven Malleable Iron Co., New Haven 4

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Link-Belt Company, Indianapolis 6
Muncie Malleable Foundry Co., Muncie
Terre Haute Mall. & Mfg. Corp., Terre Haute

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
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MINNESOTA
Northern Malleable Iron Co., St. Paul 6

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW JERSEY
Meeker Foundry Company, Newark 4

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Canton Malleable Iron Co., Canton 5
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
Maumee Malleable Castings Co., Toledo 5
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

WISCONSIN
Badger Malleable & Mfg. Co., S. Milwaukee
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

How to Select the Best Metal to Perform a Given Set of Functions

Any equipment part can be described, at least approximately, in terms of the functions it must perform. That is, it must provide a certain strength plus resistance to wear, fatigue, impact or corrosion. The finished part must provide the best combination of all necessary factors at the lowest possible cost — a cost that must include machining, finishing and assembly where applicable.

Unique Production Method Combines Desirable Characteristics

The amount and form of carbon in ferrous metals is of prime importance. The carbon content of Malleable iron (2.00 to 2.60%) provides good fluidity at the pouring stage. Yet neither flake graphite nor combined carbon is present in finished standard Malleable iron.

As the photomicrograph of standard Malleable iron shows, the carbon has been transformed into temper carbon nodules in a matrix of ferrite during the heat-treatment given *all* Malleable iron castings. The result is a metal with a unique combination of high strength, toughness and machinability.

Pearlitic Malleable irons differ from standard, or ferritic, Malleable only in that a controlled amount of the carbon is combined with the iron to form a pearlitic matrix around the temper carbon nodules. This increases strength, hardness, wear resistance and modulus of elasticity, while retaining good ductility and machinability.

TENSILE PROPERTIES — A.S.T.M. MINIMUM SPECIFICATIONS

Standard and Pearlitic Malleable Irons				
Designation	Tensile Strength p. s. i.	Yield Strength p. s. i.	Elongation % in 2 in.	Ratio of Tensile to Yield %
Standard				
35018	53,000	35,000	18	66
32510	50,000	32,500	10	65
Pearlitic				
45010	65,000	45,000	10	69
45007	68,000	45,000	7	66
48004	70,000	48,000	4	69
50007	75,000	50,000	7	67
53004	80,000	53,000	4	66
60003	80,000	60,000	3	75
80002	100,000	80,000	2	80

Strengths up to 135,000 p.s.i. tensile and 110,000 p.s.i. yield are produced commercially under individual producers' specifications.

TYPICAL BRINNELL HARDNESS NO. RANGES

Pearlitic Malleable Irons							
Designation	45010	45007	48004	50007	53004	60003	80002
B. H. N.	163-207	163-217	163-228	179-228	197-241	197-255	241-269

New Savings Result

From the wide range of properties obtainable, a Malleable iron may be selected that will most completely meet ideal design and functional requirements. Because of the great latitude of producible sizes, from a fraction of an ounce to hundreds of pounds, Malleable can be used for a wealth of applications.

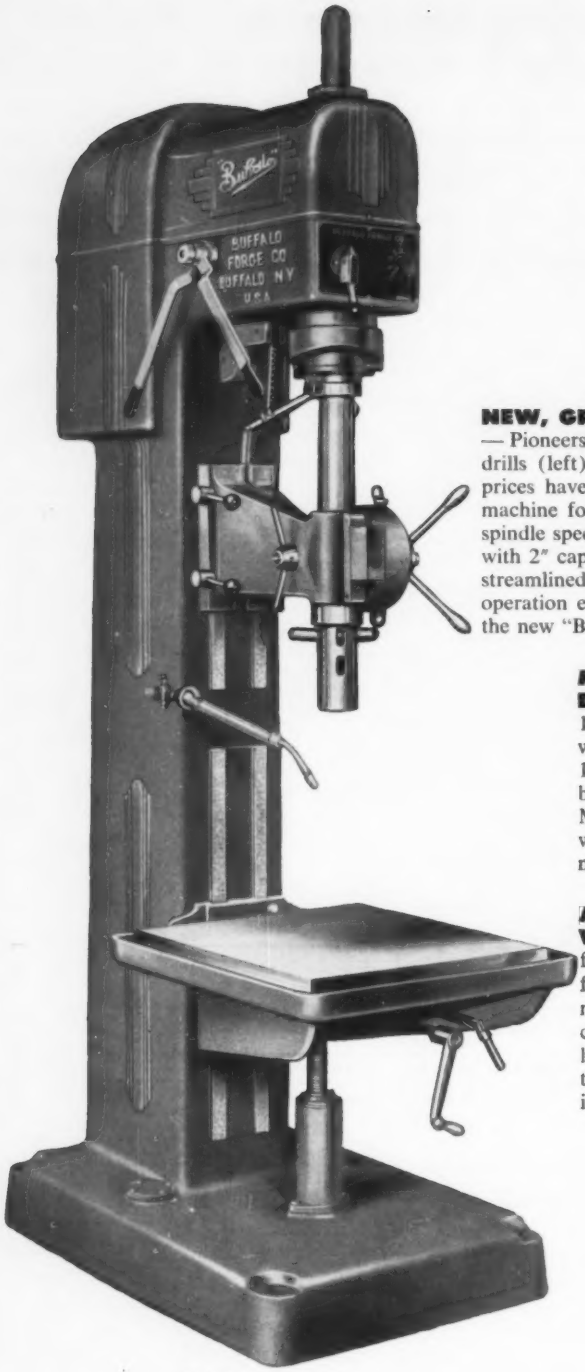
Malleable iron's economy is derived in two ways. First, the casting process is generally accepted as the most economical method of producing a finished part. Secondly, being the most machinable of all ferrous metals of similar hardness, cast or otherwise, Malleable iron castings provide exceptional economies in time, tool and power consumption.

Today's Malleable iron castings offer tremendous strength, uniformity, versatility and economy. The producers of Malleable castings are anxious to assist you in getting maximum "usability." Why not let their modern design, testing and production facilities work for you?

Send for Special Data Unit

Your copy of Data Unit No. 101 containing additional information on the benefits you can derive from Malleable iron castings is available from any member of the Malleable Castings Council. If you wish, you may direct your request to **Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.**

For more data, circle this page number on inquiry card



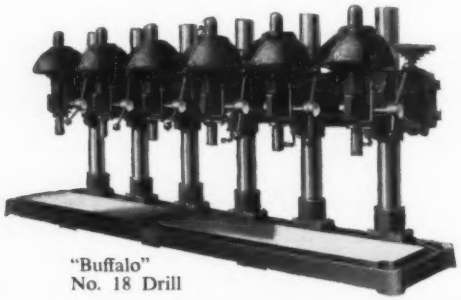
"Buffalo" R-P-Mster

WHICH OF THESE
BELONGS IN

NEW, GREATER CAPACITIES IN THE LATEST "R-P-Msters" — Pioneers in variable speed drilling machines, "Buffalo" "R-P-Mster" drills (left) are newly redesigned to bring you greater capacities. And, prices have been revised to bring you a pleasant surprise! This is the machine for high-speed, accurate production drilling, providing infinite spindle speed changes between 75 and 1300 RPM in the No. 3A Model with 2″ capacity. The new, higher capacity "R-P-Msters" have the same streamlined design, rugged and massive construction and the smoothest operation ever built into a drilling machine. Get the complete facts on the new "Buffalo" "R-P-Mster" Drills. Use convenient coupon.

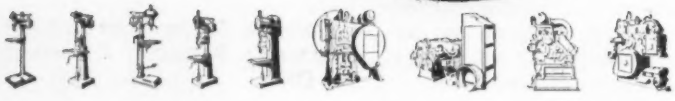
MULTIPLE OPERATIONS SPEEDED BY HEAVY-DUTY DRILL. Powerful and rigidly-built, the "Buffalo" No. 18 Drill is designed to help operators turn out better, faster work. Operation is simple; adjustments are easy. Choose from 19 models to suit your drilling needs exactly — single spindle bench or floor models and multiple units up to six spindles. Minimum deflection is the result of 6-spline alloy steel spindles which turn smoothly on precision ball bearings. Select the models best fitted to your needs — use handy coupon.

A "STAND-OUT BUY" FOR GENERAL SHOP WORK. The "Buffalo" No. 16 Drill offers you more quality features than any machine in its price range: 4 rates of power feed — 5-speed V-belt drive — hardened tool steel clutch members. These features are bound to lower your production costs — through faster and easier drilling, longest useful tool life and peak accuracy. Available in bench, floor or pedestal types, and in multiple units up to six spindles. For complete information on the "Buffalo" No. 16, mail coupon.



"Buffalo"
No. 18 Drill

ESTABLISHED 1877
"Buffalo"
MEMBER N.M.T.B.A.



BUFFALO FORGE

440 Broadway

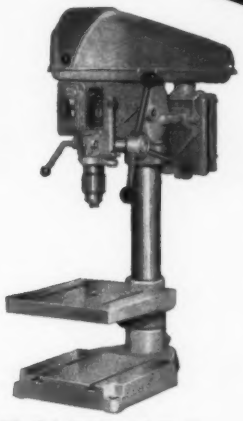
Canadian Blower & Forge Co., Ltd.

DRILLING PUNCHING

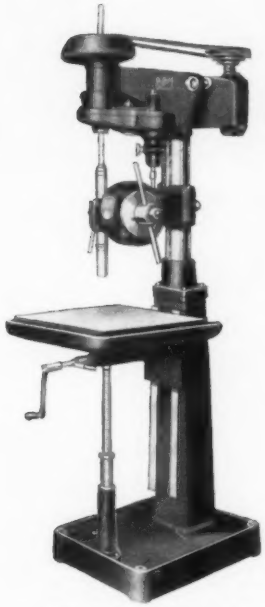
"BUFFALO" DRILLS YOUR PLANT?

NEW FEATURES MAKE A FINE DRILL BETTER. Reports from users of the new "Buffalo" No. 15 Drill are beginning to come in to us. Owners, shop foremen, operators are all enthusiastic. They like the many design improvements which result in easier, faster operation, flexibility and a minimum of maintenance. Although unusually sensitive, the No. 15 is ruggedly built for full capacity operation without wear or strain. The new line includes bench, floor and pedestal models from 1 to 6 spindles. For complete data on the "Buffalo" No. 15 Drill, check and mail handy coupon.

"Buffalo" No. 22 Drill



"Buffalo" No. 15 Drill



"Buffalo" No. 16 Drill

HIGH PRODUCTION, COMPLEX DRILLING OPERATIONS PERFORMED FASTER—With batteries of multiple-spindle "Buffalo" No. 22 Drills (above). The operator of each bank can handle 2 to 4 setups with no stopping for adjustments. These husky, 96-inch high machines operate as easily as smaller sensitive drills, yet have a capacity up to 1¼" in mild steel. No wonder operators are enthusiastic — each spindle has both power and sensitive feed; all controls are within easy reach. "Buffalo" No. 22 Drilling Machines can add more profitability to *your* shop operations. Check and send coupon to find out *how!*

COMPANY
Buffalo, N. Y.

Kitchener, Ont.

SHEARING BENDING

BUFFALO FORGE COMPANY
440 Broadway • Buffalo, N. Y.

Please send me additional information on the following "Buffalo" Drilling Machines:

☐ **No. 22** ☐ **"R-P-Master"**

☐ **No. 18** ☐ **No. 16** ☐ **No. 15**

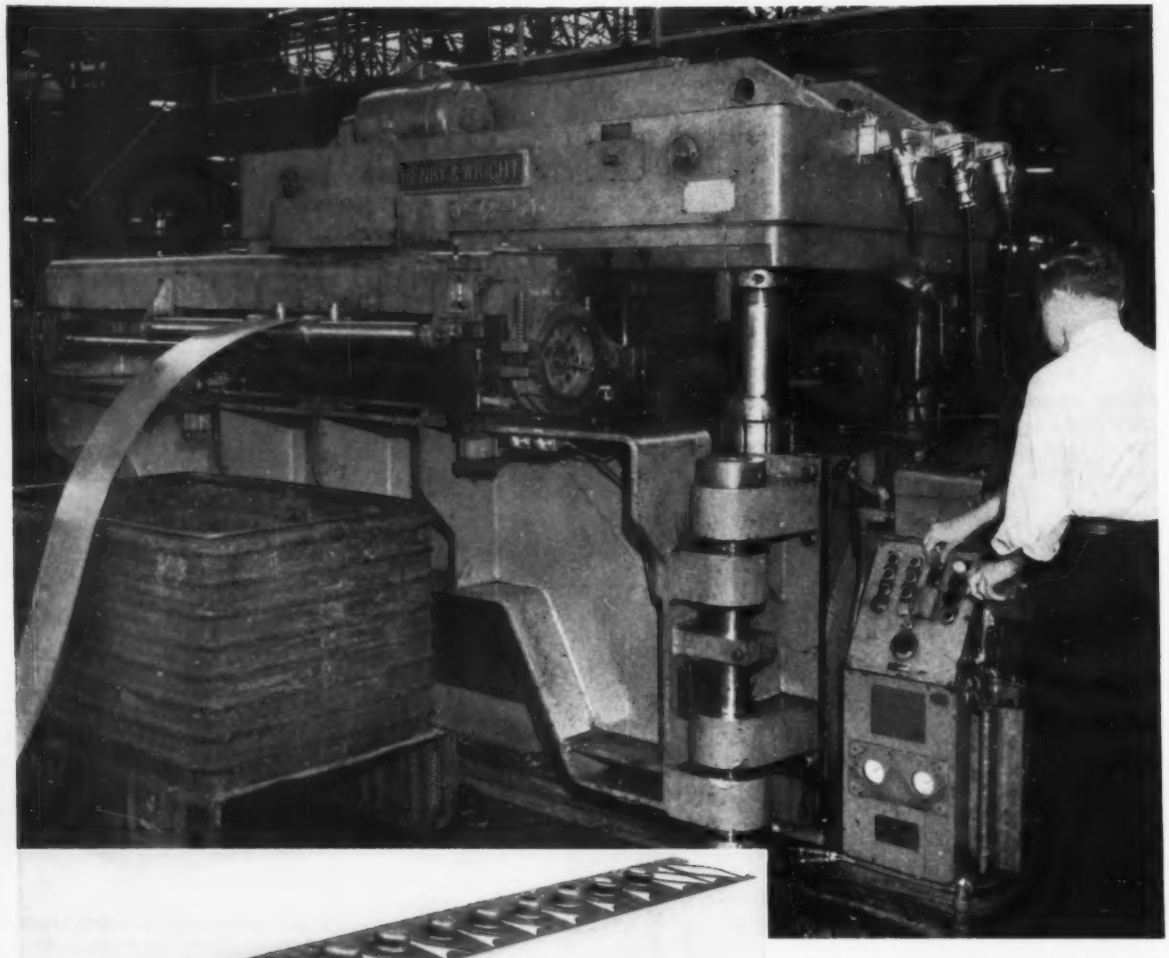
NAME ..... TITLE .....

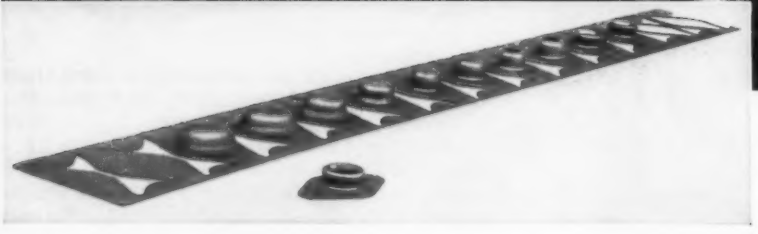
FIRM .....

ADDRESS .....

CITY ..... STATE .....

For more data, circle this page number on inquiry card





350-ton Double Crank Henry & Wright Dieing Machine, one of many at Chrysler Corporation, produces piston stops from .062" x 6" cold rolled steel. Because dies can be changed quickly, this machine which accommodates stock up to 48" wide, is highly practical for many different jobs.

Maximum Production . . . Maximum Savings

with Henry & Wright Dieing Machines

A single, versatile Henry & Wright can economically replace several conventional mechanical presses because they offer *more opportunity* for savings. Day-to-day production demands versatility, quick die changes with minimum down time, adaptability for either large or small parts — long or short runs.

Die life — a vital cost factor — can be lengthened with Henry & Wright's single or double crank dieing machines. Every feature is designed for proper die alignment, better, faster production.

Thousands upon thousands of extra parts before regrinding. All reciprocating parts are accurately guided assuring correct tool alignment and minimum wear. Because H & W's transmit power through the crosshead below the die bed, the pull-down stroke, guided by four guide rods, assures close control of the power stroke. Angular thrust from the crankshaft is received by the lower crosshead — cannot be transferred to the upper crosshead for possible punch misalignment. Saves on die regrinding — more uniform wear on tools. Reduced die clearance is also permissable—saves on die life and reduced cycle time.

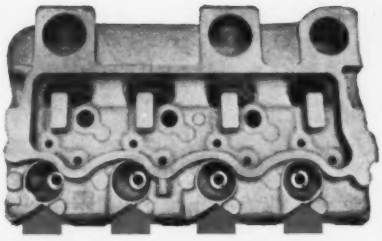
Find out today how Chrysler and other major parts producers have capitalized on the many advantages of these fine machines. Write or call your nearest H-P-M field representative today.

THE HYDRAULIC PRESS MFG. COMPANY

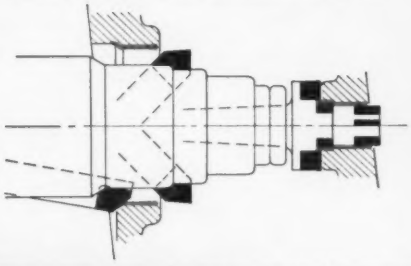
A Division of Koehring Co.

Mount Gilead, Ohio, U.S.A.

H910



MACHINES 21 CYLINDER HEAD SURFACES IN ONE PASS WITH DEPTH OF CUT BETWEEN ⅛" AND 3/16"
Rough castings are bored, plunge-faced and chamfered at a rate of 18 parts per hour. Tooling is shown below.



NEW!

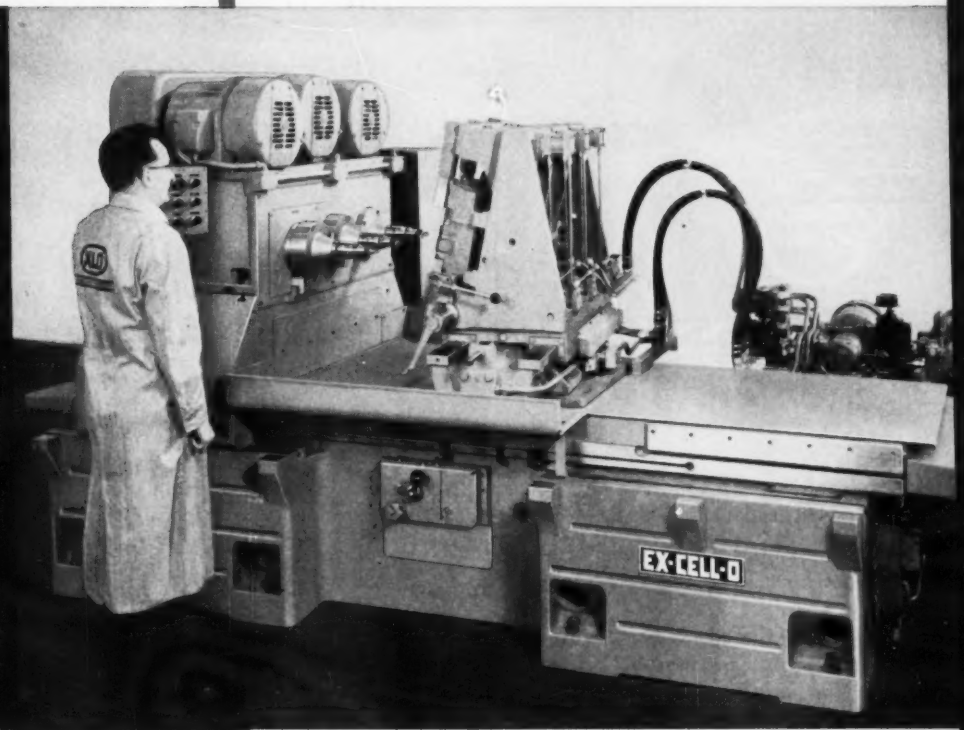
Heavy-Duty Precision Boring Machine

From base to bridge-top, Ex-Cell-O's new Style 771 Precision Boring Machine is engineered to keep pace with changing production needs and built to give years of precise profitable performance.

A specialist in fast, heavy-duty work such as the multiple machining operations detailed at left, the Style 771 (and the companion double-end Style 772) provides ample work space for complex tooling setups and bulky fixtures.

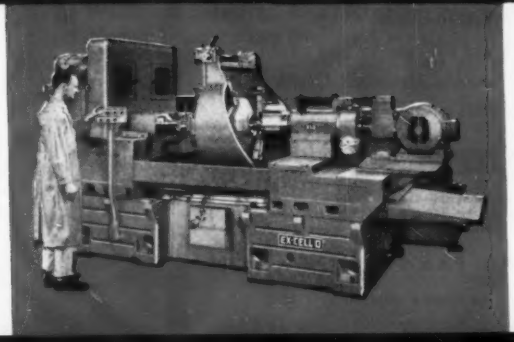
In-built versatility permits a broad range of rough, semi-finish and finish operations with automatic cycling. Rigid construction gives the "beef" needed for machining large, heavy parts, and supplies a wide margin of steadiness for high production of smaller precision parts.

Ex-Cell-O Precision Boring Machines can put greater precision into your products at lower per-unit cost. Get the full story from your local Representative, or write direct.



RIGHT: Style 771 machines both 4-and-6-cylinder tractor components. As cycle starts, table rapids to left, spindles rotate and feed traverse begins. At end of stroke, table rapids out to clear tooling; fixture indexes, cycle repeats for second set of holes.

BELOW: Double-end Style 772 performs multiple machining operations on tractor gear case cover.



XLO EX-CELL-O FOR PRECISION

EX-CELL-O CORPORATION *Machinery Division*
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

58-49

Schiess KZ 250 Double Column Vertical Boring Mill machining a 6-station index turntable, 24" high, 96" diameter, used by automotive manufacturer for an automatic machine.

"Our Schiess vertical boring mill DOES THE JOB 3 TIMES FASTER, MORE ACCURATELY, with a BETTER FINISH!"

Hahn Manufacturing Company, 5332 Hamilton Ave., Cleveland

Jobs of increased size and time limitations no longer hold back production at Hahn Manufacturing Company.

The company reports: "Our Schiess machine has already handled a 60" high cast iron cylinder and a 108" diameter ship propeller. We cut production time by using the two boring heads together. For instance, one head can be used for roughing while the other is finishing. Or one head can be used for turning while the other is boring.

"Our operators claim the machine is just about foolproof. They like the cross-rail electro mechanical controls. They also praise the hydraulic pre-selection of speeds, the finger-tip control for direction of feed and rapid traverse, and the all-vertical gear drive. Another thing—no special training was needed. Our regular machinists put it right to work as soon as they learned the controls.

"The Schiess mill does our big jobs just about three times faster, provides a better finish, is more accurate and results in less spoilage."

Get to know this product of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be happy to help you size up this heavy producer for your heavy production needs.

Write for catalog and complete specifications.

Standard Model KZ Double Column Vertical boring mills are available with 80", 98" and 118" turning diameters.

SCHIESS

AMERICAN SCHIESS CORPORATION • 1232 Penn Avenue, Pittsburgh 22, Pa.

For more data, circle this page number on inquiry card

this 480 ton giant has 5 heads

WALDRICH SIEGEN

combined planer and milling machine

No need to risk the inaccuracies that come from moving a workpiece weighing up to 100 tons from machine to machine for different operations. One set-up is all you need with this Waldrich Siegen machine. And just think of the tremendous savings in set-up time and costs.

Three milling heads take care of milling, boring and thread cutting operations; another head does planing and grinding; and there's a planer side head, too.

The Waldrich patented tool retracting mechanism in the planer head raises tool in a straight vertical plane after unclamping, repositions tool automatically, then reclamps. Cross rail is clamped hydraulically in exact horizontal position, located by separate electric drive. Built-in optics confirm accurate location.

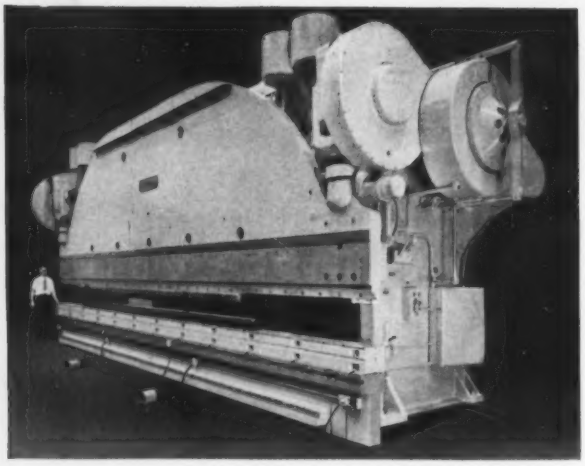
Rigid, you bet—from top to bottom! Waldrich construction features a base plate crossing under machine and tying columns and bed into one ruggedly rigid unit. And there's a total of 900 h.p. working for you.

Write for all the specs on this mammoth producer. And ask a Waldrich engineer to discuss them in detail—in terms of your production needs.

WALDRICH SIEGEN

american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANIA



How Cincinnati® Press Brake construction lowers job costs

Only accurate machines can make accurate bends. The accuracy obtainable from a press brake begins with its structural rigidity. Cincinnati® Press Brakes give you maximum accuracy and rigidity because of these construction features:

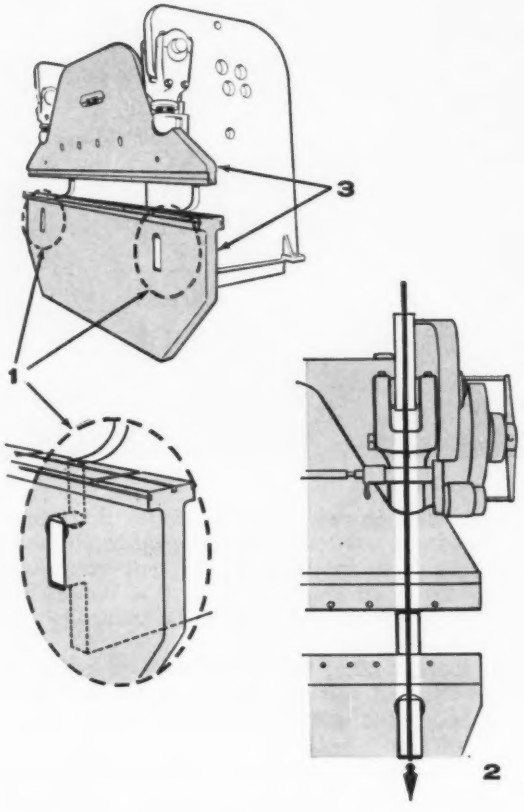
1. Interlocked construction—The bed is supported directly by the housings, by means of hand-scraped bearing shoes. No welds are used as load supports, so every Cincinnati is free from welding strains.

2. Center line loading—Since the Pitmans which drive the ram *straddle* the housings, weaving of the frame and cramping of the ram slides and shaft bearings is eliminated. All operating forces are contained within the housings.

3. Deep beds and rams—It's a simple engineering fact that the rigidity of a press brake's ram and bed increases approximately as the cube of the depth. For this reason, most of the weight of the ram and bed of a Cincinnati® Press Brake is disposed in depth, rather than thickness. Tests prove their working surfaces remain parallel within .005" under capacity loads.

To you these construction features mean money saved in the long run. A Cincinnati® Press Brake is more accurate than other makes when you buy it . . . and will stay that way throughout its long life.

Write Department D for Catalog B-5.



Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO. Cincinnati 11, Ohio, U.S.A.

NOW AVAILABLE

GRADED NATURAL DIAMOND MESH

FOR EFFICIENT GRINDING

No. 1—Cubes | No. 2—Blocks | No. 3—Irregular Blocks | No. 4—Needle Grains

When natural diamond is crushed by our controlled methods, four mesh shapes are generated: No. 1 (Cubes); No. 2 (Blocks); No. 3 (Irregular Blocks); No. 4 (Needle Grains).

Increased grinding efficiency can be obtained by using mesh sizes with a controlled shape distribution.

This new service extended to the manufacturers of diamond wheels by Industrial Distributors (Sales), Limited, ensures a consistent supply of this material in graded mesh sizes in the wheels supplied to you.

PARTICLES GREATLY MAGNIFIED TO SHOW SHAPE

YOU CAN DEPEND ON NATURAL DIAMONDS

INDUSTRIAL DISTRIBUTORS (SALES), LTD.

For more data, circle this page number on inquiry card

Q.

Are you drilling holes in your MONEY POCKET?

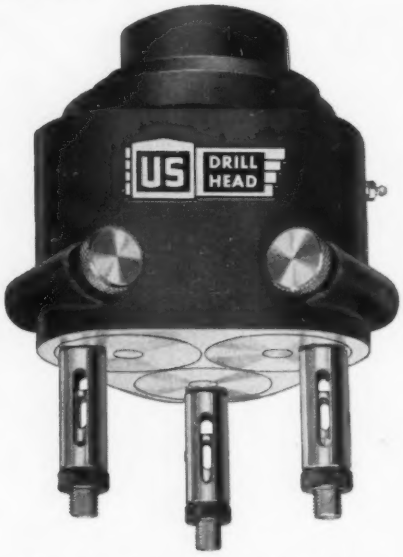
A.

NOT when you use *U. S. DRILL HEADS!*

That's because Adjustable U. S. Drill Heads are designed and built for profit-making performance!

Positive all-gear drive . . . Shaved gears for smooth, quiet operation . . . High factor of safety in design for greater reliability . . . Anti-friction bearing mounting of shafts and spindles for permanent alignment . . . Double Duty tools—when your drilling machine has a reversing spindle, you can drill and tap the same hole pattern with one head.

Write for Catalog AD-57. Or, send specifications of your requirements. No obligation, of course.



Standard Adjustable style is made in 5 models—58 sizes. A rugged head ideally suited for high production with flexibility.

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

WHEN "SECONDS" COUNT...

GO MIKRON

ACTUAL SIZE

No. 132-01 MIKRON

Spur Gear Hobbing Machine with 15-Second Spacing Accuracy

The "DIFFERENTIAL" between an ordinary gear hobbing machine and a MIKRON is...

MIKRON QUALITY

Ask for our Bulletin RH-132-01 which describes the new MIKRON 15-Second Spacing Accuracy Machine.

RUSSELL, HOLBROOK & HENDERSON, INC.

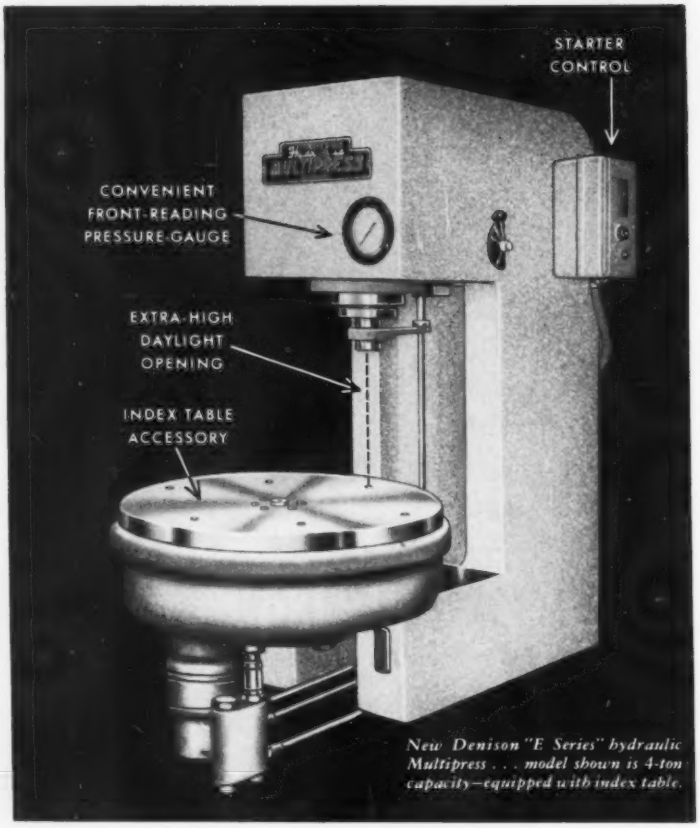
292 Madison Avenue, New York 17, N. Y.

DENISON *Announces...*

NEW 2 to 8-ton "E-SERIES" Multipress line

- *BENCH PRESSES WITH BIG PRESS PERFORMANCE*
- *LOW-COST REPLACEMENT FOR OUT-MODED FLOOR PRESSES*
- *MORE TONNAGE PER DOLLAR...MORE DAYLIGHT FOR WIDER TOOLING RANGE*

FOR 101 PRESSING JOBS . . . *new "E Series" Multipress packs maximum big press performance in bench press space. 4-ton Multipress is shown above on rigid, lightweight bench accessory.*



New Denison "E Series" hydraulic Multipress . . . model shown is 4-ton capacity—equipped with index table.

HERE'S WHY IT'LL PAY YOU to check your production against the features of Denison's new "E Series" hydraulic Multipress line—

- **BIG PRESS PERFORMANCE** in a bench model size. Ram speeds: Closing up to 1450 ipm. Pressing up to 570 ipm. Return up to 920 ipm.
- **MORE DAYLIGHT** than comparable presses ... 18" opening adapts extra-wide range of tooling.
- **SAVES FLOOR SPACE**...compact design (16" x 26" x 49") can do floor press jobs in bench press space.
- **GREATER TONNAGE** for its size than any comparable press.
- **MOBILITY**...makes operations more flexible. Fast and easy-to-move *anywhere* in your production area.
- **MANUAL OR AUTOMATIC OPERATION**...Can also be equipped with Denison accessories—including feeds and index tables.
- **LOW-COST**...designed expressly to *replace* outmoded, heavy floor presses *and still do the job.*
- **OPERATING FEATURES**...oil smooth hydraulic power system . . . completely self-contained unit . . . rapid cycle time . . . fast, simple setup . . . interlocked safety controls . . . precision-controlled, adjustable ram pressures.

THE SECRET of Denison's new "E Series" hydraulic Multipress line is in this production-proved fact: Properly applied lower pressures produce better quality products—*more efficiently and with less scrap*—than misapplied higher pressures. Construction and control features of the "E Series" Multipress are designed to give *maximum performance at lowest possible cost.*

Write for full details in Bulletin M-34.

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1152 Dublin Road • Columbus 16, Ohio

Denison, Denison HydrOILics, and Multipress are registered trademarks of Denison Eng. Div., ABSCO

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CLEVELAND DETROIT
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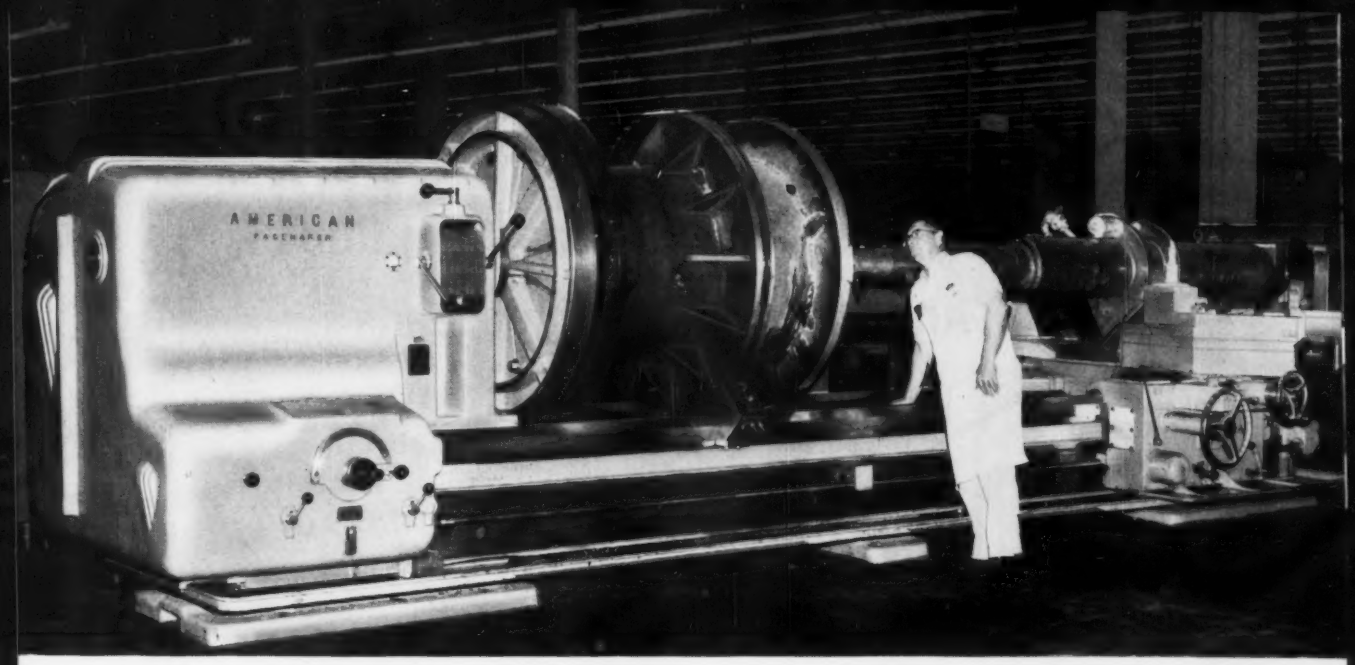
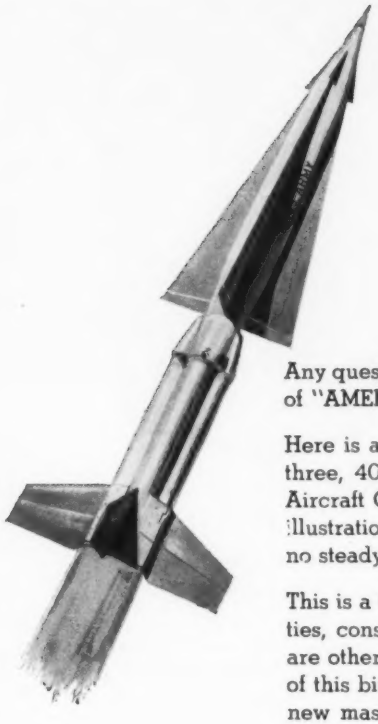
DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS





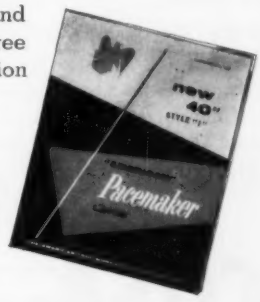
HERE'S THE *VISUAL* ANSWER!

Any question about the capacity of "AMERICAN" Lathe Spindle bearings or the stiffness of "AMERICAN" Spindles is certainly answered by this illustration.

Here is a 40" "J-9" "AMERICAN" Deluxe Model Hydraulic Duplicating Lathe (one of three, 40" "J" "AMERICANS") in the Charlotte, North Carolina plant of the Douglas Aircraft Company, Inc., boring a 54" diameter bulge die weighing five (5) tons. This illustration shows an ingenious roller rest made by Douglas but on many operations no steady rest is used.

This is a 60 horse power lathe with spindle and spindle bearings of tremendous capacities, consequently is ideally adapted to "elephant" operations of this nature and there are other exclusive design features contributing to the excellence of this big lathe, such as the extremely rigid 4-vee bed; the brand new massive 7½" diameter spindle tailstock; the patented three bearing, triple drive spindle; its 100% anti-friction construction and full automatic oiling.

The many ultra modern and superlative features of "AMERICAN" Deluxe Model Pacemakers are described and thoroughly illustrated by bulletin No. 150. May we send you one?



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

For more data, circle this page number on inquiry card

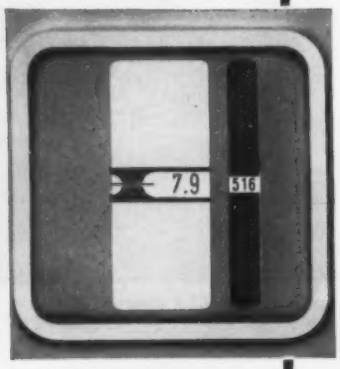
DECKEL *LK Machine Tool Series Brings You...*

Direct Numerical Readings To .0001"

And Interchangeable Heads

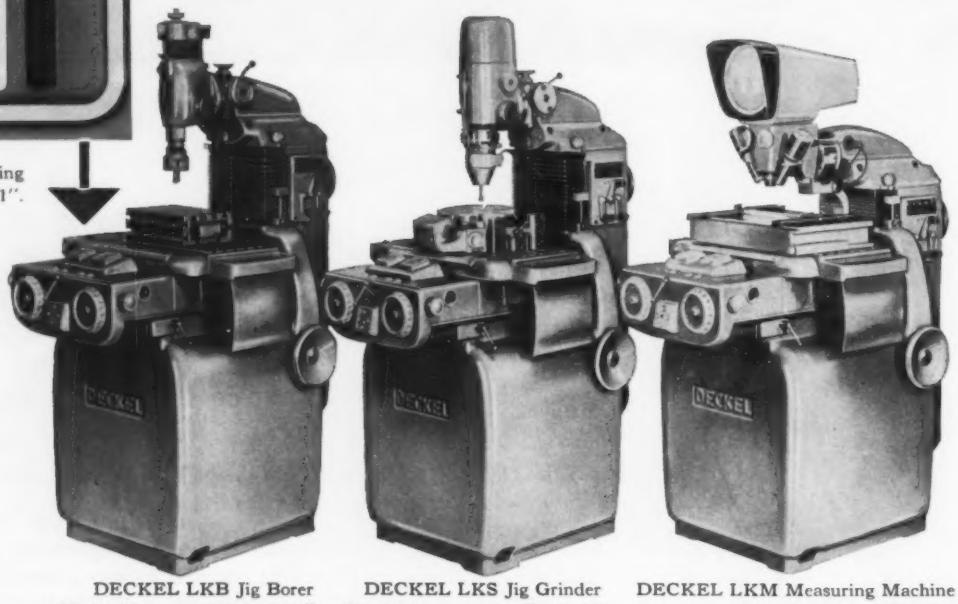
for

Optical Coordinate



Projection screen showing scale readings to .0001".

Jig Boring **Jig Grinding** **Profile Measuring**



DECKEL LKB Jig Borer
Worktable area: 25.6" x 11.8"

DECKEL LKS Jig Grinder
Worktable area: 25.6" x 11.8"

DECKEL LKM Measuring Machine
Magnification: 10X, 20X

This outstanding machine tool development couldn't be more timely. The new DECKEL LK series of optical coordinate machine tools combines economy with extreme precision—at a time when these two factors are highly critical.

Three Machines In One—Simple interchangeability of jig boring, jig grinding and profile measuring heads gives you a choice of one, two or three machines on one universal base. Change from one head to another takes only minutes. Used individually, each one of these machines will give you remarkable accuracy and performance.

Direct Numerical Readings—For the first time on any machine tool, coordinate table settings *can be read directly in numbers* to ten-thousandths (.0001") of an inch. No conversions or interpolations are needed. Reading errors are practically impossible. Actual positioning accuracy is within .00012".

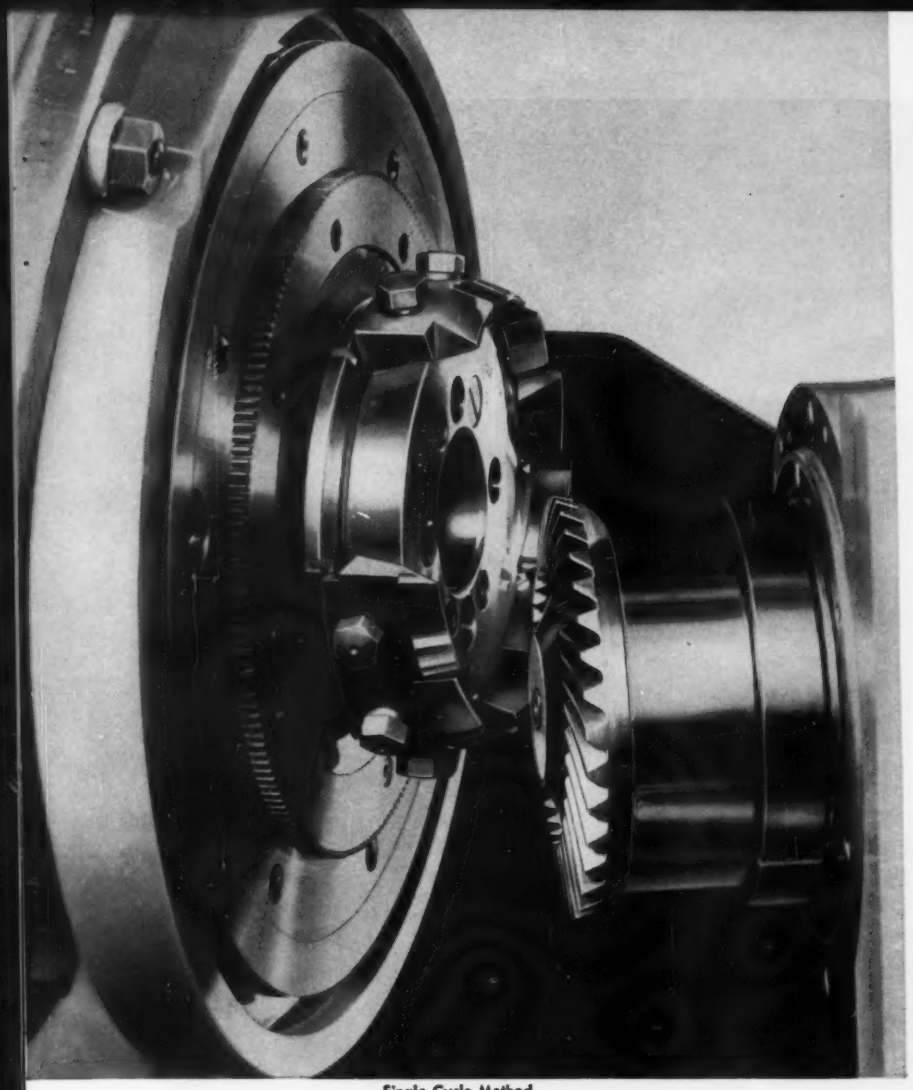
Thermal Expansion Compensation—The inherent accuracy of these machines is protected by a unique thermal expansion compensating device—built-in to the supporting bracket. Dissipation of heat from the gear box and drive motor provides additional thermal stability.

Write For Additional Information

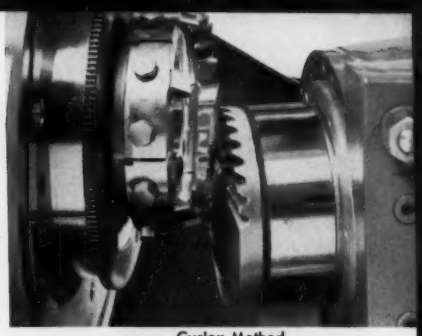
COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

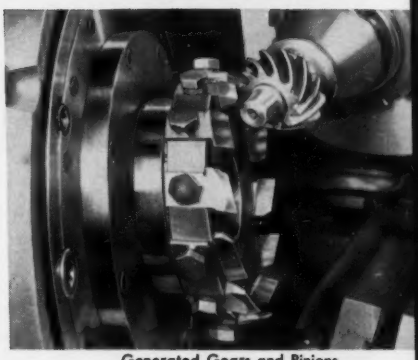
In Canada contact COSA CORPORATION OF CANADA, LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario



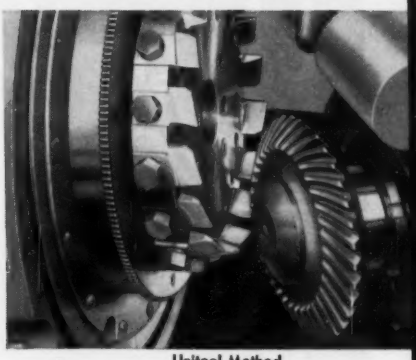
Single Cycle Method



Cyclex Method



Generated Gears and Pinions



Unitool Method

Cut gears with *four* different methods on *one* machine

If you expect your gear needs to change over the years you'll appreciate the exceptional versatility of the Gleason No. 108 Hypoid Generator. With this one machine you can cut both gears and pinions by four different methods:

Single Cycle® Method. Using this method you can cut nongenerated gears four to five times faster than previously possible on machines of this type. Cradle and work head are locked in position. The last rotation of the Single Cycle Cutter finishes both sides of a tooth space. You cut the mating pinions on the same machine using the conventional single-roll Generating Method.

Cyclex® Method. For certain applications you can use the extremely fast Cyclex Method on the No. 108 Generator. You cut nongenerated gears in one completing operation from the solid blank.

Generated Gears and Pinions. You can produce both gears and pinions on this machine with the Generating Method. Here, a relative rolling motion takes place between gear or pinion and the rotating cutter.

Unitool* Method. If you want to cut small quantities of spiral bevel, Zerol® bevel, or hypoid gears with a minimum of tooling, you can use the Unitool Method. You cut both gears and pinions with a single cutter. This method is particularly useful for experimental gears for prototype work.

The No. 108 Generator cuts gears up to 8½" diameter at a 10:1 ratio and to a maximum of 4 DP. You can get the same versatility in cutting larger gears with the No. 118 Hypoid Generator which handles gears up to 18" diameter, 10:1 ratio, to a maximum of 2 DP. A third model, the No. 28 Hypoid Generator, cuts gears up to 33" diameter at 10:1 ratio, 1½ DP.

Send for free bulletins on all three machines.

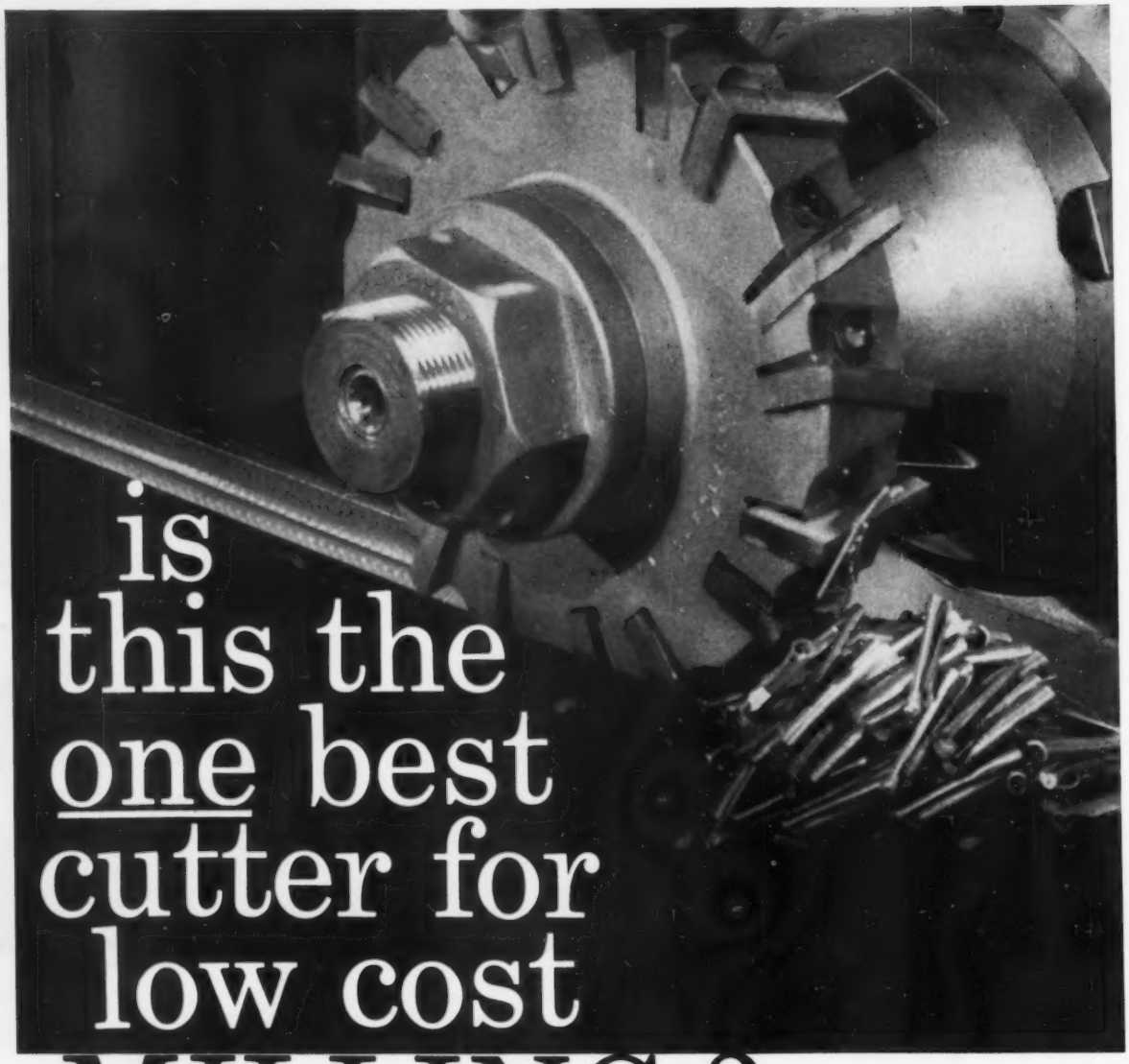
*Trademark

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

72

For more data, circle this page number on inquiry card



is this the one best cutter for low cost MILLING ?

We happen to know it is—on this specific job!

But frequently operators will rely on "pet cutters" for milling a variety of parts and materials. Result: Either higher costs or inferior finish . . . and usually both.

The problem has always been to match the cutter *exactly* to work and machine on every job.

Solutions to problems like these are our main product. And only after a penetrating study of machine, work, depth of cut, speed, feed rates and finish requirements do we recommend any cutter.

The inserted blade cutter pictured above is an example. On the work and the machine for which it was designed it is "the one *best* cutter for low cost milling."

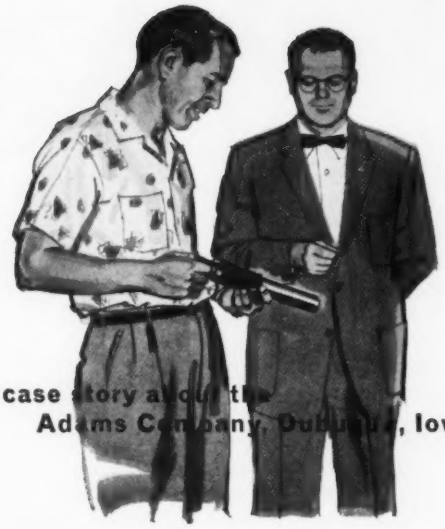
We would welcome the opportunity to tell you more about this unique cutter selection service. Write:

This helpful new booklet tells you how to reduce the cost of chips and improve your milling and boring performance. Ask for a free copy of booklet No. 68B.

THE
INGERSOLL
MILLING MACHINE COMPANY
CUTTER DIVISION
505 FULTON AVENUE • ROCKFORD, ILLINOIS

Bob showed them a new product that ended rust on work and tools—

STANDARD Special Transparent Coolant



A case story about the Adams Company, Dubuque, Iowa

Before Standard Oil lubrication specialist Bob Wenger told The Adams Company management about Standard's SPECIAL TRANSPARENT COOLANT, there had been considerable trouble with rusting of work and machines in the plant. There had also been trouble with deposits on the ways of the grinding machines. Rust occurring on parts being processed was resulting in damage and even losses. This has been changed.

"Since we changed to your SPECIAL TRANSPARENT COOLANT, we have not had any rusting or deposits on our machine tools, and this product has eliminated the rusting problem on parts being processed through our plant," says Harlow Adams, president of the company.

The Adams Company found they received important additional benefits as well. Operators could now see their work clearly. There was less wheel loading. Because the coolant didn't foam, more of it stayed on the wheel resulting in cooler operation. Faster cuts were obtained with finer wheels. Finer wheels gave better finishes. Periods between dressings were extended. Tolerances were maintained.

Research, development and more than two years of field testing have gone into Standard's SPECIAL TRANSPARENT COOLANT. This is the pay-out to you on the research done by Standard Oil to bring you better metalworking products. Find out more about Standard's SPECIAL TRANSPARENT COOLANT. Call your nearby Standard Oil lubrication specialist in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Quick facts about
Special Transparent Coolant

- Clear, transparent fluid.
- Able to control corrosion and rust on work and machines.
- All chemical. Does not support bacteria growth.
- Unaffected by humidity.
- Nonfoaming.
- Fire resistant.
- Odorless.

No rust. Shaft ground with Standard's SPECIAL TRANSPARENT COOLANT shows no rust on inspection by A.T. Murphy, General Superintendent, Harlow Adams, President, and Bob Wenger, Standard Oil lubrication specialist.

You expect more from STANDARD *and get it!*

PRODUCING

INTRODUCING

The LE MAIRE SU-5 Unit

Here's real "Building Block" construction for simple, economical automation! For here, on just one rotary indexing machine you'll find six *identical* LeMaire way-type hydraulic units performing nine *different* machining operations . . . with an arrangement which permits easy, rapid change-over to process three different sized parts as required.

The part is a diesel engine rocker shaft bracket. Setups for three different size parts are readily made with adjustable adaptors on the fixtures and adjustable spacers on the milling arbors. Production is 112 pieces per hour at 100% efficiency. Here's what happens at each station.

(1) Load **(2)** Drill large hole **(3)** Spot face and chamfer large hole **(4)** Ream large hole **(5)** Straddle mill top of boss and mounting face **(6)** Drill small cross hole to half depth **(7)** Drill small cross hole to full depth **(8)** Finish mill mounting face **(9)** Finish bore large hole to .0005" tolerance.

The LeMaire SU-5 way-type units used on this machine are extremely suitable as "building blocks" which can be used over and over in widely varied applications. They are entirely self-contained, with cross-keyed construction which permits ready removal and re-mounting. Features of the units include variable delivery pump, hardened and ground ways, automatic lubrication and spindle speed changes. For ease of maintenance and replacement, all component elements are manifolded to provide ready accessibility.

The machine itself features precision balanced spindles for milling and boring, a variable speed pump to power the hydraulic indexing mechanism, automatic lubrication, and J.I.C. electrical and hydraulic systems. Perhaps a similar arrangement of versatile LeMaire way-type units can simplify your production machining problem. Call or write for consultation with a LeMaire field engineer.

with LE MAIRE

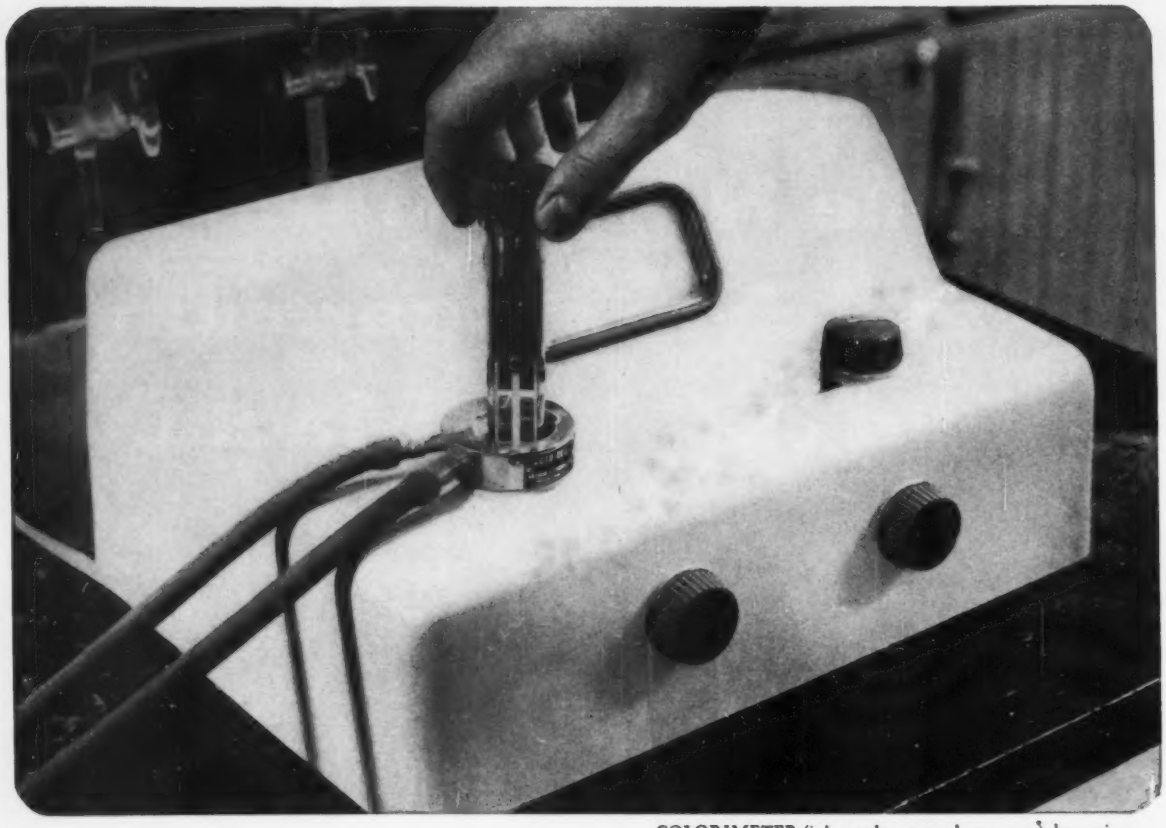
Versatile New LE MAIRE Unit Powers Every Operation On This LE MAIRE Machine

LE MAIRE MACHINE TOOL COMPANY

2657 S. TELEGRAPH ROAD
DEARBORN, MICHIGAN

Designers and Builders of
Special High-Production Machines

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



COLORIMETER (inherently extremely accurate) determines percentages of molybdenum, tungsten, cobalt and manganese in A-L tool steel to insure consistent, high quality.

Colorimeter measures exact chemical composition of Allegheny Ludlum tool steel melts

Accurate adjustment of alloys guarantees uniform heat treatment, predictable dimensional changes, reduced grinding, standardized machining operations.

Close control of molybdenum, tungsten, cobalt and manganese is at the heart of a good tool steel melt. In addition to the usual testing methods, Allegheny Ludlum's chemical laboratory checks these metals with Colorimetry because of its inherent, extreme accuracy.

On the basis of the Colorimeter's findings, it is possible to make carefully calculated furnace additions of ferro-alloys, insuring precise control over chemistry. This guarantees your receiving the *exact* analysis order after order, providing *uniformity of heat treatment, predictable dimensional changes, reduced grinding and standardized machining operations.*

Colorimetry is but one step toward careful control over composition. Allegheny Ludlum also sets exacting purchasing specifications on raw materials and scrap. Quality Control checks all incoming orders to see that they conform with these specifications. Another guard toward your getting your exact specifications: each ingot bears a metal tab showing heat number.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

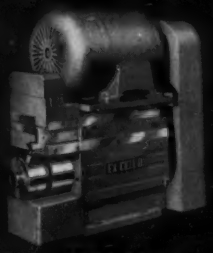
ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. M-14

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

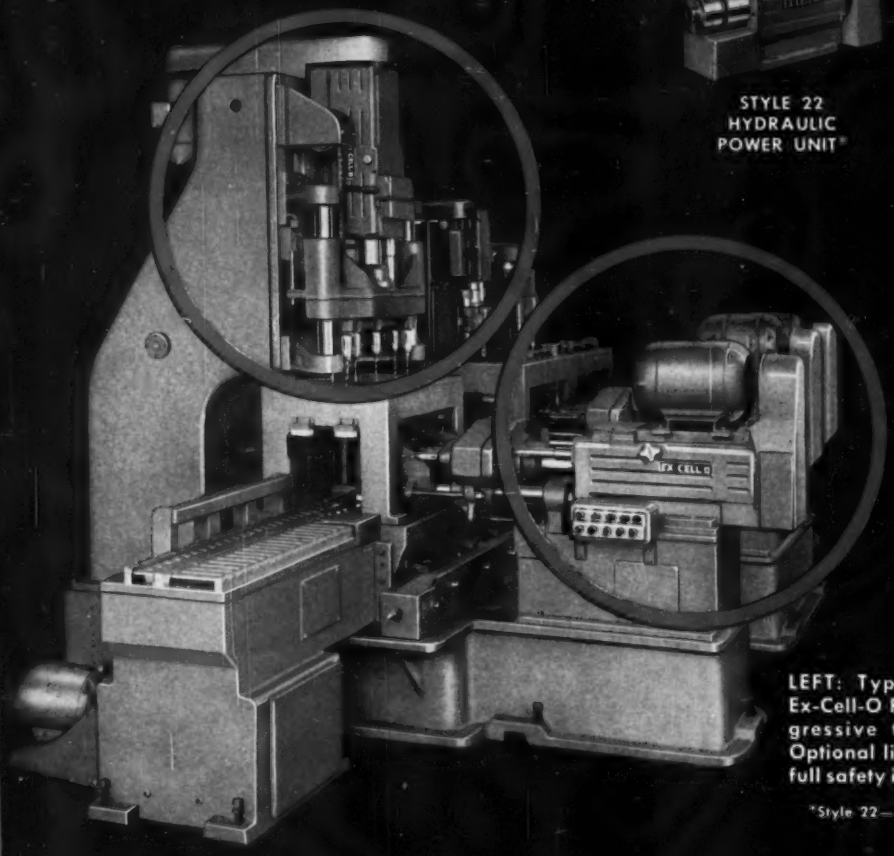
XLO EX-CELL-O FOR PRECISION



STYLE 22
HYDRAULIC
POWER UNIT*

STYLE 28-A
HYDRAULIC POWER UNIT

STYLE 20
HYDRAULIC POWER UNIT



LEFT: Typical application shows six Ex-Cell-O Power Units installed on a progressive transfer-type machine tool. Optional limit switch assemblies provide full safety interlock and start-cycle control.

*Style 22—8-inch Stroke; Style 22-L—12-inch Stroke

POWER + VERSATILITY

58-11

With Ex-Cell-O Quill-Type Hydraulic Power Units

Why buy a power unit that's made to do just one job—when a single, low-cost Ex-Cell-O Hydraulic Power Unit will do more work in a broad range of applications?

Compact Ex-Cell-O Power Units are used for drilling, spot-facing or reaming in special-purpose machines. When these operations are no longer desired, the units can be quickly and easily relocated to perform numerous other operations.

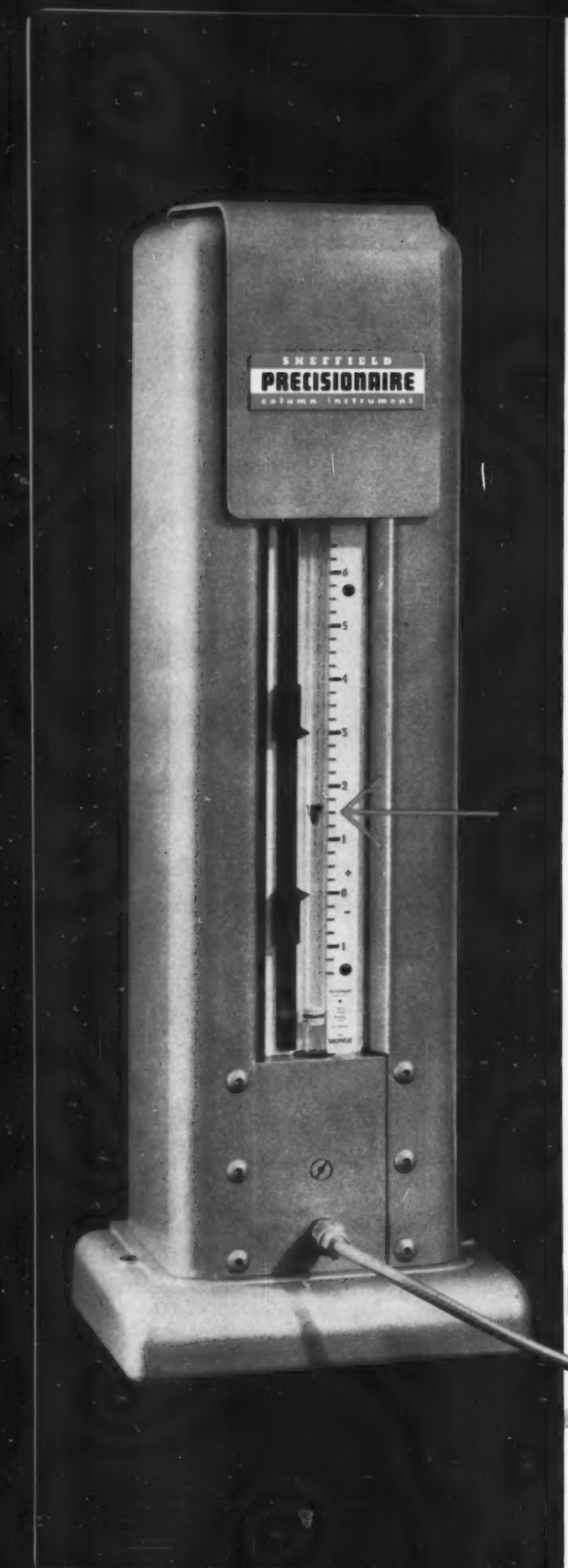
Because of their simple, precise control in automatic cycling, they've even been used in light, high-production broaching, material handling and many unrelated operations.

Ex-Cell-O Hydraulic Power Units are self-lubricated, perform in fast cycles, and are easy to install, particularly where space is at a premium.

For complete information on Ex-Cell-O Quill-Type Power Units, and how they can lower your production costs, call your local Ex-Cell-O Representative or write direct.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



THE ONLY MOVING PART FLOATS ON AIR

Precisionaire®: the gage that always works.

The Sheffield Precisionaire® gage is the most accurate, most dependable, most widely accepted air gage money can buy. Here's proof:

There are more Precisionaires in use than all other air gages combined.

Of the nation's 500 largest companies, every one engaged in precision manufacturing uses Sheffield. Only Sheffield offers these advantages:

Precision built into instrument

Amplification and linearity are built into the glass float tube permanently—immune to "hidden drift" and misadjustment. Amplification is entirely pneumatic, linear over the full 8" scale, even for dimensions smaller than .185". Scale is the longest available anywhere. A Precisionaire is ready to go without warm-up.

Choose and change amplification

Only Sheffield lets you select the amplification you need from 50:1 through 100,000:1 or greater. When your requirements change, you convert to another standard amplification in 2 minutes with an inexpensive kit. A Precisionaire stays new.

Maintenance-free—always

The only moving part—the float—is suspended in a column of filtered air. This illustrates the design simplicity, inherent proof that a Precisionaire never wears out. You can depend on accurate, repeatable dimensional readings day-after-day, year-after-year no matter how often your requirements change.

Choose gaging elements you need

Only from Sheffield can you select the **exact** size sensing element you need from the broadest inventoried line available. Your complete Sheffield gaging system carries a single nameplate guarantee and is backed by a coast-to-coast network of gaging centers.

Unskilled people read it faster

Simple two-master setting is **always** reliable and is the only **proven** way to compensate for every operating variable. Tolerance display is as great as desired. Bold, clear markings read directly in fractions of an inch, without parallax. Gage response is virtually instantaneous even when the part is remotely located. You check multiple dimensions with one quick eye-sweep over compactly grouped columns. Computing circuits eliminate "figuring" on complex multiple checking.

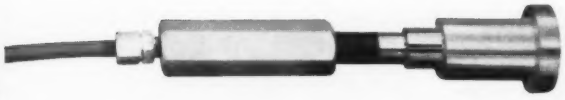
Sheffield knows air gaging

During 18 years of leadership, Sheffield has simplified, refined and polished air gage design for maximum accuracy and reliability. A reason you can depend on Sheffield recommendations is that Sheffield makes **every** type of dimensional indicating gage—pneumatic, electronic, electric and optical-mechanical. Your needs **alone** form the basis of a proposal.

Write for catalog

Find out now about the dollar advantages of Sheffield air gaging systems. Contact your Sheffield gage engineer through your Yellow Pages, or write direct for Catalog No. AGS-1-59

THE SHEFFIELD CORPORATION
Dayton 1, Ohio, U.S.A. CL 4-5377



the **SHEFFIELD** *corporation*
of Bendix Aviation
manufacture and measurement for mankind

For more data, circle this page number on inquiry card

"Far Superior to its Competition"...

. . . states Mr. Creighton Blanchard, toolroom superintendent at New Hampshire Ball Bearings, Inc., Peterborough, New Hampshire

THE NEW, IMPROVED THOMPSON TYPE D HAND FEED

SURFACE GRINDER

is winning enthusiastic approval wherever precision work is required

Here's what Mr. Blanchard has to say about the new Type D machine:

"We have three grinders in our toolroom—a Thompson and two competing machines. In our general toolroom grinding, especially on carbide and hard metals, we find the Thompson Type D so superior that we have recently purchased another Thompson just like it. All our precision work goes on the Thompson."

Compare these features

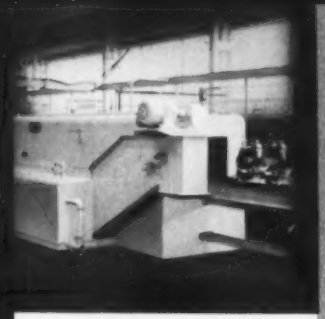
- Steel roller anti-friction slides eliminate ball creep and increase rigidity.
- 14" standard vertical capacity under 7" wheel at no extra cost with no loss in vertical capacity when using wet attachment.
- Solid support through entire length of bearing quill assures extra fine finish.
- 5 inch table movement per turn of handwheel improves quality of finish and speeds up operations.
- No backlash, anti-friction ball nuts and screws on cross feed prevent wheel from creeping away from work in shoulder grinding.
- Swing-out stop for table dog contact permits quick movement to wheel dresser.
- Immediate delivery available.

Send for descriptive literature on the new Thompson Type D Grinder.

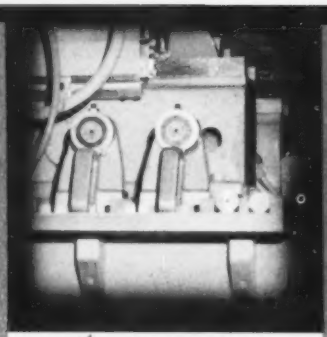
THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

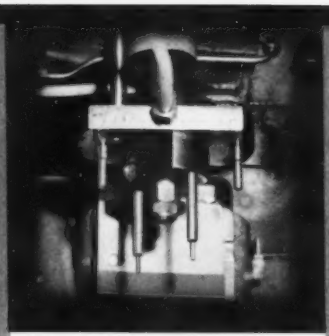
Thompson
SURFACE GRINDERS



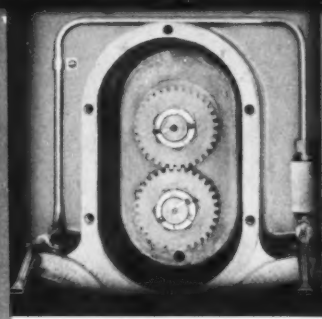
CLEANLINESS: Fixtures and parts are washed on return conveyor.



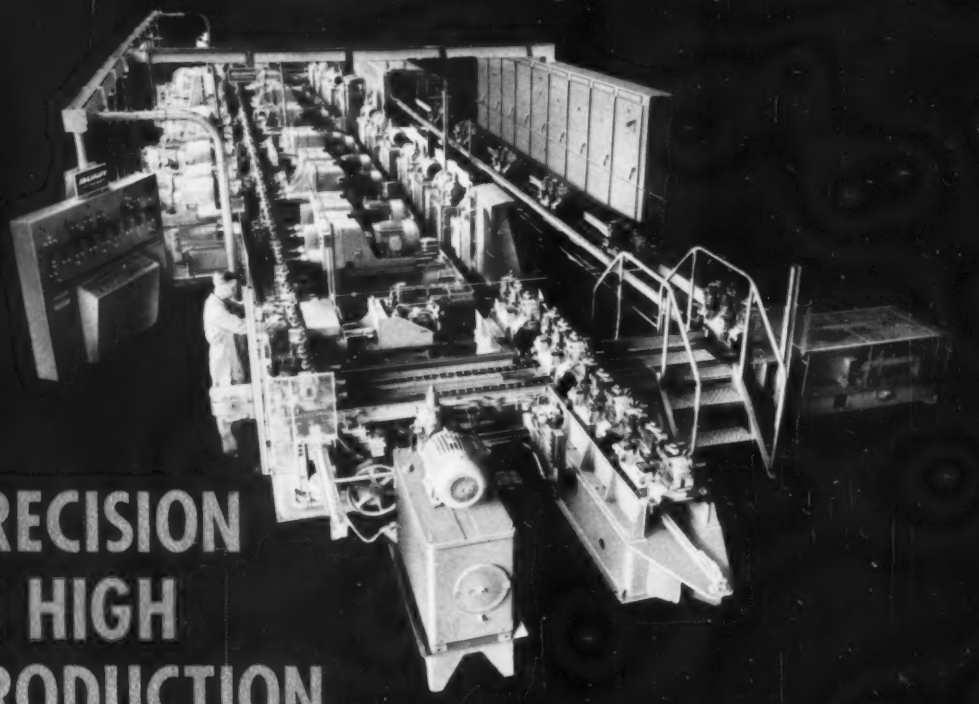
SETUP & TOOL CHECK gages are provided at all key stations.



PROBING stations at key points locate and signal any tool breakage.



CHANGE GEARS in heads for changing cutting speeds if desired.



PRECISION IN HIGH PRODUCTION

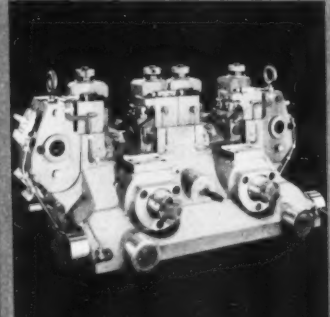
Tolerances as close as a few tenths can be maintained on Buhr ECONOMATICS when required

PART—hyd
CYCLE TIME
OPERATIONS
STATIONS, t
OPERATIONS
reami
form-
probi
TOLERANCES
as a f
with

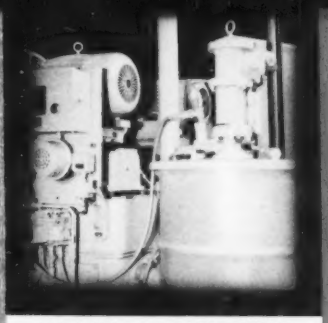
SPOT GAGING of parts in process without stopping machine.

BUHR "BUILDING-BLOCK" construction does not sacrifice rigidity.

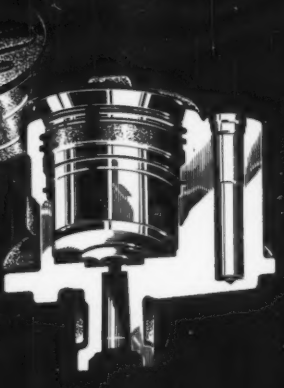
PRECISION BUILT FIXTURES give 100% parts interchangeability.



CONVERTIBILITY is further aided by providing 10 future potential work-stations.



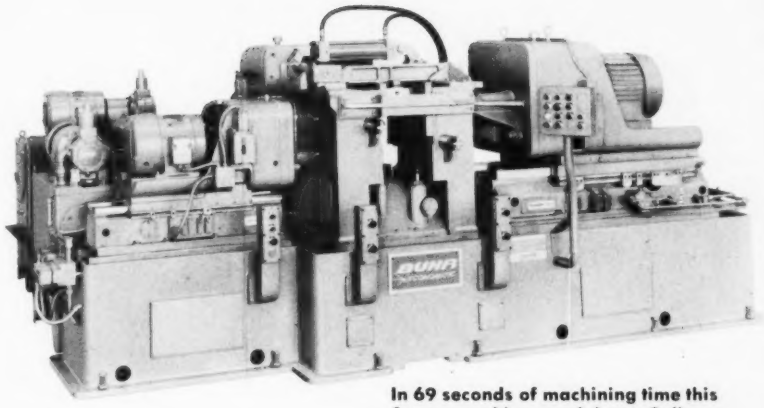
AUTOMATIC LUBRICATION
of entire machine
except motors.



-hydraulic pump housing
TIME—24 secs. for 2 parts
TIONS—115
NS, total—26 stations
TIONS—drilling, tapping,
eaming, spot-facing, boring,
orm-grooving, feed-out facing,
robing and gaging
ANCES—as low in some cases
s a few tenths of a thousandth
vith excellent surface finish

er
ons.

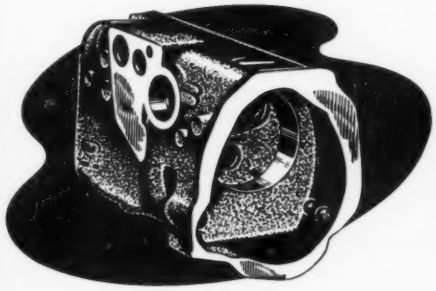
GOOD ACCESS for tools
etc., provided by ample
room between stations.



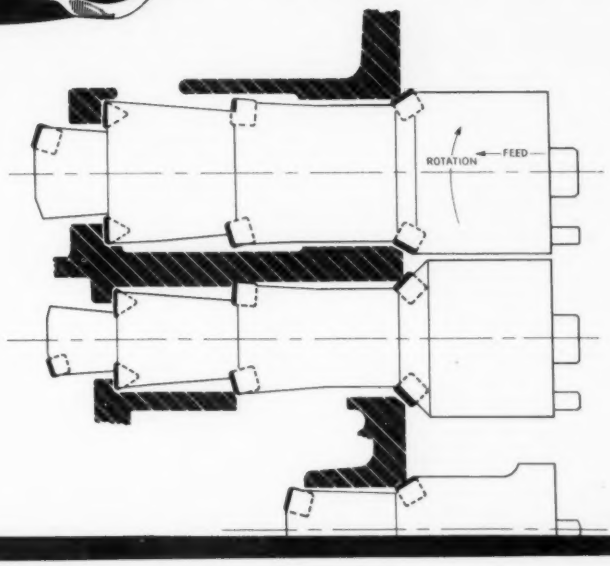
In 69 seconds of machining time this 3-way machine rough bores 9 diameters, semi-finishes 4 bores, machines 7 chamfers and 3 faces.

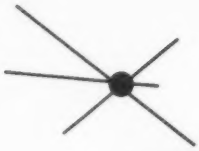
ECONOMATICS SAVE MONEY IN LOW PRODUCTION, TOO

By combining numerous operations through multi-diameter boring tools, using throwaway inserts, only 4 simple 2-way and 3-way Buhr Economatics produce all bores in the transmission housing for one of the major tractor producers.



Diagrammatic sketch below shows the three spindles of the right-hand head of the machine illustrated above. Throw-away inserts are combined in specially designed tools to rough bore, chamfer and face various openings. Related dimensions can be held closely because they are formed by the same tool. Tool grinding is unnecessary and set-up time is minimized.





BUHR

MACHINE TOOL COMPANY specializes in the design and construction of practical versatile multi-operation machine tools.

Basic features stressed in all Buhr machine tools include:

QUALITY—rugged design and manufacturing accuracy are combined to provide long trouble-free operation.

CONVERTIBILITY—Buhr uses standardized "building-block" parts wherever possible in its machines, fixtures, etc. All such parts are held to interchangeability tolerances.

PRODUCTIVITY—dependability is designed and built into Buhr machines to insure maximum productivity per man-hour consistent with production requirements.

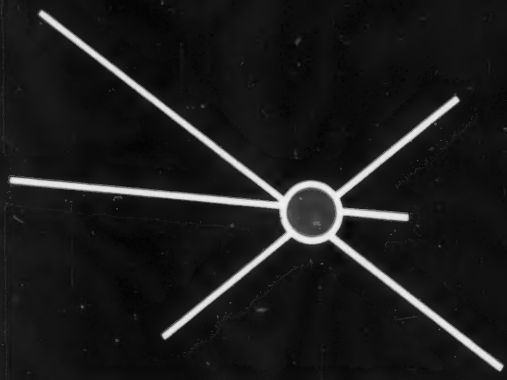
LOW DOWN TIME—every effort is made to minimize downtime by careful attention to future maintenance requirements, etc.

VERSATILITY—Buhr machines have a well-earned reputation in industry for their versatility. Many can produce a variety of parts with minimum changeover time.

Buhr welcomes the opportunity of discussing your machining requirements. Give us a call or drop us a line.

BUHR
MACHINE TOOL COMPANY

ANN ARBOR, MICHIGAN



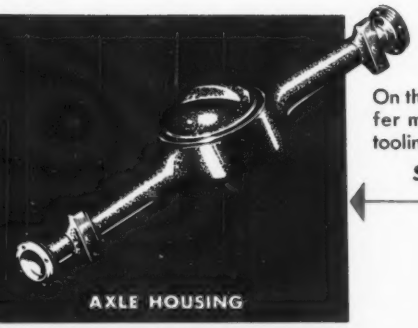
BUHR

the symbol of quality in multiple operation high and low production equipment

two more examples

Typical jobs on various *BUHR* Economatics

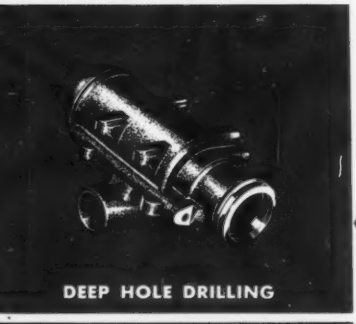
Any random selection is naturally incomplete. If you don't see a part that looks like yours, send us a part print and we will be happy to tell you what Buhr Economatics are doing to cut costs on your type of part.



AXLE HOUSING

On this part, a short Buhr Economatic transfer machine has eliminated an annual retooling cost averaging $40,000 per year.

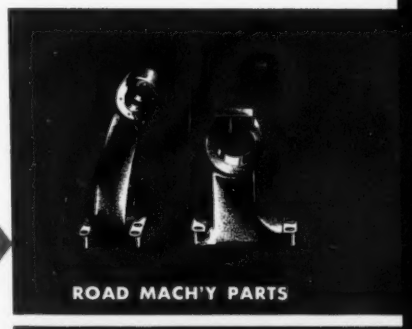
Short Transfer Machine #C-5188



DEEP HOLE DRILLING

7 different road machinery parts are produced on one automatic machine. Settings for different parts are pre-selected with a dial switch.

Shuttle-type Machine #C-4552



ROAD MACH'Y PARTS

On this conventional Economatic, a ¼" hole is drilled 7¾ in. deep in 5 steps (2 parts at a time). A proximity switch stops machine if a drill should break.

Dial Index Machine #C-5117

VALVE BODIES

Cast manifolds (both LH and RH) are produced at a rate of one every 21 seconds on a 20-station machine.

Transfer Machine #C-4524

MANIFOLDS

From 19 to 28 operations per part are performed on 32 different valve body styles on the same machine with only simple tool changes.

Trunnion Machine #C-5021

ALUMINUM OR CAST IRON

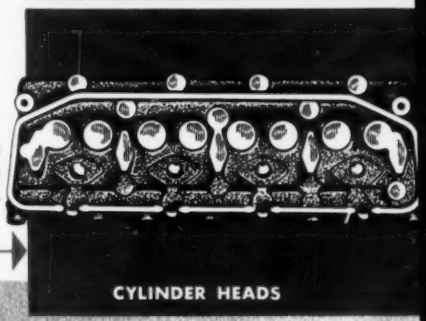
43 operations are performed on either aluminum or cast iron housings at 21 stations. Time cycle is 21 seconds per part.

Transfer Machine #C-4098

CONTROL ARM

A 4-station 3-way (2 horizontal, one vertical) dial index Economatic for drilling, reaming and facing control arms.

3-way Machine #C-4005



CYLINDER HEADS

All spark plug holes are combination drilled and reamed on a simple 2-fixture 4-station machine with a 12-spindle head.

Single-station Machine #C-4941

Ask for more information by machine number

BUHR MACHINE TOOL COMPANY

ANN ARBOR, MICHIGAN

ULTRA-PRECISION GEARS

for Research and Development Work

The new Red Ring Gear Development Center has been inaugurated to assist research and development engineers who encounter difficult precision gear problems — especially in the automotive, aircraft, missiles, marine and farm equipment industries.

The new "Center" furnishes ultra-precision gears when such are needed for prototype work. It also offers an advisory service covering all phases of gear practice — design, metallurgy and processing techniques.

Included in the "Center's" facilities are special gear machine tools and tooling and a completely equipped gear laboratory.

Write for specific suggestions on your gear problems.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
GEAR HONING AND ELLIPTOID

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

8103

For more data, circle this page number on inquiry card

One of a bank of 7/16" RA-6 spindle Acme-Gridley automatics installed at Gillette's Boston, Mass. plant

Close up of tooling zone showing adjusting knob in 5th position

Precisely Formed, Marked, Knurled,

Broached, Micro-finished, Reamed and Tapped . . .

ON ONE ACME-GRIDLEY AUTOMATIC

in *4½ Seconds!*

The adjusting knob on this new adjustable razor is but one of its several precision components made by The Gillette Safety Razor Company on 9/16" Acme-Gridley six spindle bar automatics. The requirements were extremely exacting, *with as many operations as possible performed in the primary setup!*

For example: nine positions are stenciled on a turned portion of the O. D. with interrupted knurling held in exact peripheral location to the marking. In addition, close tolerance hole sizes are involved and *all* external burrs completely removed. All tools had to be synchronized to produce the exacting number-knurl relationship on the periphery.

Working in close cooperation with Gillette engineers, National Acme specialists took full advantage of the wide-open tooling zone, independently operated tool slides and the extreme accuracy and flexibility of direct camming . . . to perform an ingenious job of tooling. Many operations normally considered "secondary" were accomplished in the primary setup. Costly rehandling and "second machine investments" were reduced.

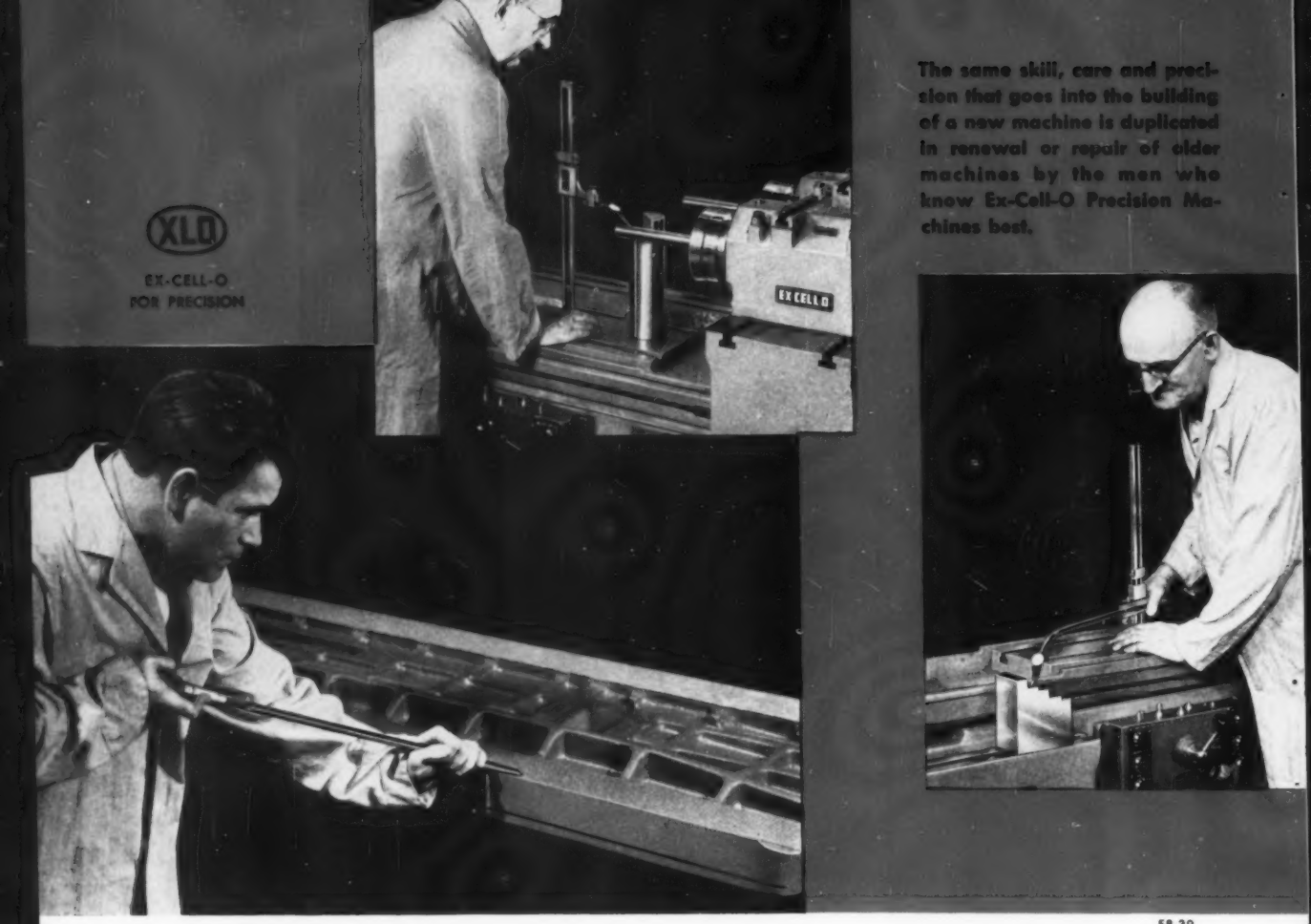
Write or ask one of our representatives for the complete story on the industry's most modern approach to *your* cost reduction problem.

Pioneer in Circumferential Automation

National Acme

The National Acme Company
179 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.



The same skill, care and precision that goes into the building of a new machine is duplicated in renewal or repair of older machines by the men who know Ex-Cell-O Precision Machines best.

58-39

Are you ready for the business upsurge?

RENEW YOUR EX-CELL-O MACHINES NOW!

Better business is just around the corner, and now's the time—when your present Ex-Cell-O equipment may not be in continuous service—to release idle machines for renovation before full production begins once more.

Ex-Cell-O's facilities for machine repair or renewal are geared to your specific needs—whether it's a planned modernization program or an emergency repair job. The service is fast, the workmanship thorough; and, of course, necessary replacements are Ex-Cell-O "original equipment" precision parts.

For complete satisfaction and guaranteed results, put your Ex-Cell-O machines in the hands of the men who know them best. Contact your local Ex-Cell-O Representative, or call direct for complete details.

EX-CELL-O CORPORATION *Machinery Division*
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

- Heat-Treating Facilities Eyed
- Capital Goods an "Econovane"
- MAPI Depreciation Drive Continues
- Washington Briefs

Keeping up with Washington

Loring F. Overman

WITH NEW METALS AND ALLOYS essential to plane, missile, and space programs, the 200 or so companies that produce heat-treating equipment are being allotted more important roles in the defense picture. A speedy evaluation of the capabilities of the industry, both for immediate accomplishment and for expansion in the event of emergency or mushrooming need, has, therefore, been planned by the Metalworking Equipment Division of the Business and Defense Services Administration.

In charge of the program, as an advisor to Niels A. Olsen, Director of the Metalworking Division, BDSA, is James H. Sands of Rockford, Ill. On six months leave from his post as vice-president of the Rockford Eclipse Fuel Engineering Co., Mr. Sands will serve without compensation as monitor of the evaluation program. Emphasis of the Metalworking Equipment Division in the past has been on machine tools, Director Olsen observed, but the increasing importance of new and harder metals requiring special heat-treatment dictates more active consideration of the heat-treating division of business and defense facilities.

Capital Goods an "Econovane"

Washington crystal-gazers consider that the business outlook for 1959 will be determined by what happens in the fields of machinery, machine tools, and allied equipment including tools and dies. An upturn in these fields, say the economists, will signal genuine and lasting business improvement.

Of the half-dozen business levels reported on at the United States Chamber of Commerce's recent press conference on business outlook, only the future of capital equipment appeared nebulous. Economists remember that a forecast of the 1958 recession was given as early as April of 1957—the time when orders for special tooling started a slide which continued until August of 1958.

Economists are now hopeful that the upturn in special tooling demand—up 40 per cent in October of 1958 over August—may be taken as confirmation that the upward trend of business will not be limited to soft goods. No great upward surge was indicated at the year's end, but an average increase of 15 per cent in 1959 was anticipated. Continuing demand for quick delivery of special tooling was accepted as another favorable sign.

MAPI Depreciation Drive Continues

Echoing the thought that plant modernization and expansion spark prosperity, the Machinery and Allied Products Institute continues to publicize the importance of favorable depreciation formulas as elements in investment decisions. Research director George Terborgh has observed that "a liberalization of depreciation will both augment the available capital funds and otherwise increase the incentive for their investment. A change in the opposite direction will restrict funds and make investment less attractive."

Mr. Terborgh's comments, made during a Tax Institute symposium, were a part of MAPI's program to convince tax-planners that a favorable depreciation formula would not represent a loss in revenue, tax-wise. Instead, MAPI pointed out, a tax inducement for a company to keep its plant and equipment in a state of top efficiency would have the opposite effect. The incentive to invest would be enhanced, earlier expansion would be encouraged, and production at top efficiency would result in lower prices, increased sales, and pyramided tax revenues.

In addition to its efforts on behalf of depreciation concessions, MAPI is also pressing for major tax reform to encourage export operations. Appearing before the House Ways and Means Foreign Trade Subcommittee, MAPI Counsel Rowland C. Brown proposed a five-point tax reform plan. He testified that "major tax reform could contribute more than any other single action which the United States Government could take to facilitate expansion of private international operation and investment, ultimately at little or no cost to the Treasury."

Washington Briefs

First loan of an assortment of government-owned machine tools to an educational institution under the terms of a law enacted by the Eightieth Congress has been announced. The tools have been sent to the Forsyth County Industrial Education Center at Winston-Salem, N. C. The state built a $475,000 installation to house the new educational facility which will provide "an advanced curriculum in trade and industrial subjects above the high school level but below college level."

The Army's Chief of Research, General Arthur Trudeau, is urging a speedup of the lead time between conception of a defense idea and final production of items involved. He also urged "more capacity for rapid conversion and re-equipping military production lines with modern tools and machines already stockpiled or available from consumer-goods production lines."

The Internal Revenue Service has issued Technical Information Release No. 114 to explain the additional depreciation allowed in the first taxable year on tangible property under the provision of the Technical Amendments Act of 1958—Public Law 85-866. Copies of the bulletin can be had from the Internal Revenue Service.

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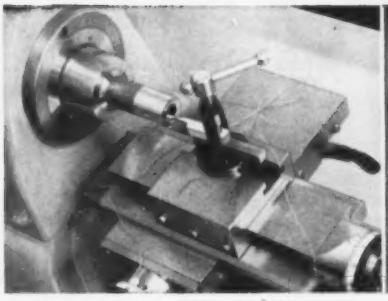

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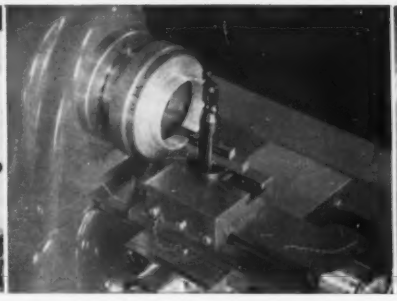

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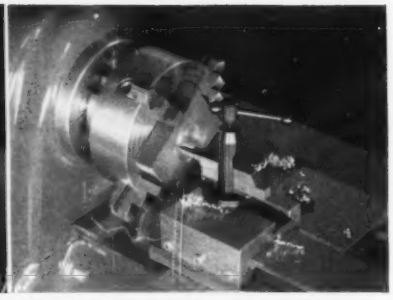

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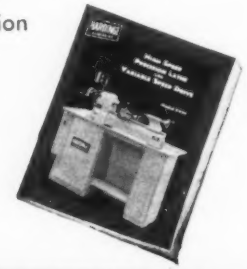

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Machinery
FEBRUARY 1959

How To Be Superior

ONE hundred and twenty-five years ago, when Brown & Sharpe was founded in that Down East city that it helped to "put on the map," Lucien Sharpe expounded the homely philosophy that the simple way to be superior is "to be superior." Thousands of slogans have been coined since that day to serve as goals for business enterprises and to intrigue potential customers. But few modern slogans are as convincing in implying product excellence.

Superior quality is just about the best feature that can be built into a product. When sales lag, business executives will gripe about excessive freight rates for their manufacturing areas, oppressive taxation, labor monopolies, and so on. If superior quality of their products can be established in the minds of customers, such handicaps should be comparatively easy to overcome by progressive manufacturing concerns.

As a grandson of one of the founders of Brown & Sharpe recently pointed out, the thing that is important today is to have a vision of creating machines that are not only equal to those of competitors but which will supersede all former concepts. Actually, that spirit has been the impetus to progress in the machine tool and allied industries producing metal-cutting or fabricating equipment. Standard machine tools may resemble their predecessors of twenty years ago facially, and their primary motions may be the same, but after these observations, in most cases, all semblance ceases.

Modern machine tools have been greatly strengthened in order to efficiently apply the stronger cutting alloys now available; faster feeds and speeds have been provided; hydraulic power has been adopted for faster and foolproof operation of moving members; greater accuracy has been built into components; and electric motors of much higher horsepower ratings than in bygone years are being supplied to meet modern ideas of metal removal.

Even greater progress has been made in the field of machine tools developed especially to meet the unique requirements of the automobile and aircraft industries. Automated machine lines are a phenomenon of the postwar years and this type of equipment will be increasingly applied in the effort to attain higher planes of productivity. Developments of the electronics industry have resulted in the application of magnetic-tape controls for the automatic performance of complex operations that can be readily changed to suit different work-pieces. Machines for hydroforming and hydro-spinning were not in existence a comparatively short time ago. This is true of a considerable number of other types of metalworking machines.

Progress such as this is the vitality of any industry. Competition spurs progress and promotes superiority.

Charles O. Herb

EDITOR

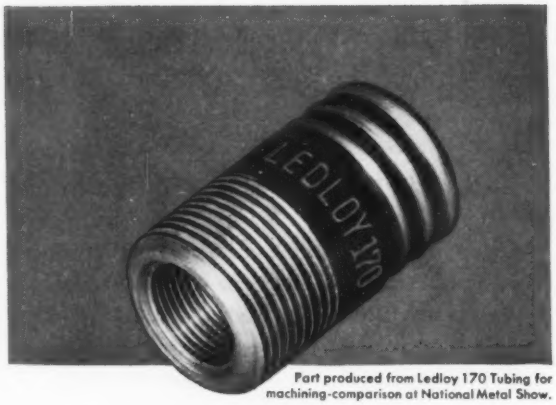
NEW LEADED STEELS FROM RYERSON

Now, machine parts faster than ever before

NEW LEDLOY 170 TUBING

average machining speed 170 surface feet per minute

Here's the fastest-machining steel tubing ever produced —and only Ryerson has it available for immediate shipment from stock. Ledloy® 170 is a cold drawn, seamless product of low carbon analysis with .15% to .35% lead added. It promises a minimum increase of 25% in productivity of machined parts or components. Sizes range from 1" to 2½" O.D. with maximum ⅜" wall thickness. Other sizes can be supplied promptly.



Part produced from Ledloy 170 Tubing for machining-comparison at National Metal Show.

NEW LEDLOY 375 BARS

average machining speed 375 surface feet per minute

This newest addition to Ryerson free-machining screw steel stocks is the world's fastest-machining steel. Assigning the figure 100 to B-1112 and using this as a base, Ledloy 375 has a machinability index of 205 plus. It rates about 64% higher than B-1113 and about 20% higher than Ledloy 300.

Ledloy 375 bars presently in Ryerson stocks include rounds in sizes from ¼" to 1", hexagons ¼" to ⅝".

Ask your Ryerson representative for complete details on these new steels. And call Ryerson for an unequaled selection of cold finished bars and tubing, including the largest stocks of Ledloy 300 (also known as Ledloy A) and Rycut® leaded alloys—the fastest machining in their carbon ranges.

MACHINING COMPARISON*
Ledloy 170 Tubing vs. Nonleaded Tubing

	Ledloy 170		MT-1015	
	Speeds	Feeds	Speeds	Feeds
Center drill	172 s.f.m.	.005"	110 s.f.m.	.005"
Form tool	172 s.f.m.	.0008"	110 s.f.m.	.0008"
Boring tool	172 s.f.m.	.007"	110 s.f.m.	.007"
Cutoff	172 s.f.m.	.0013"	110 s.f.m.	.0013"
Thread	27 s.f.m.	—	20 s.f.m.	—
Tap	18 s.f.m.	—	12 s.f.m.	—
Production time	35 seconds		49 seconds	

* As demonstrated at National Metal Show, Cleveland, 1958.

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a step forward in bevel gearing...

HELIXFORM SPIRAL BEVEL AND HYPOID GEARS

By combining rotary and axial cutter movements, a basically different type of tooth surface is formed. Abstract of a paper presented by C. B. King, associate chief research engineer, and G. M. Spear, research engineer of Gleason Works, Rochester, N. Y., at International Conference on Gearing held by the Institution of Mechanical Engineers, London, England

A NEW DEVELOPMENT in the art of manufacturing hypoid and spiral bevel gears, such as those used in passenger cars, trucks, buses, and tractors, is the Helixform process. This method is similar to past practice in that the teeth are cut by face-mill type cutters and with intermittent indexing of the work-piece.

Because this type of cutter is used, Helixform pairs are identical in appearance with conventional hypoid and spiral bevel gears having longitudinally curved teeth of varying depth. In normal sections, the gear teeth have straight sides. The profiles of the mating pinion teeth are, of course, curved.

A basic difference between the new process and previous methods is in the kind of gear-tooth surface obtained. The Helixform tooth surface is helicoidal instead of conical. This permits the pinion of a pair to be generated from a counterpart of its mate, except for the lengthwise curvature required to localize tooth bearing.

Stems from Formate Process

Gear members of Formate hypoid pairs are usually finished with conical, single-cycle, face-mill cutters. The machines used do not have a rotating cradle as do generating machines. Other

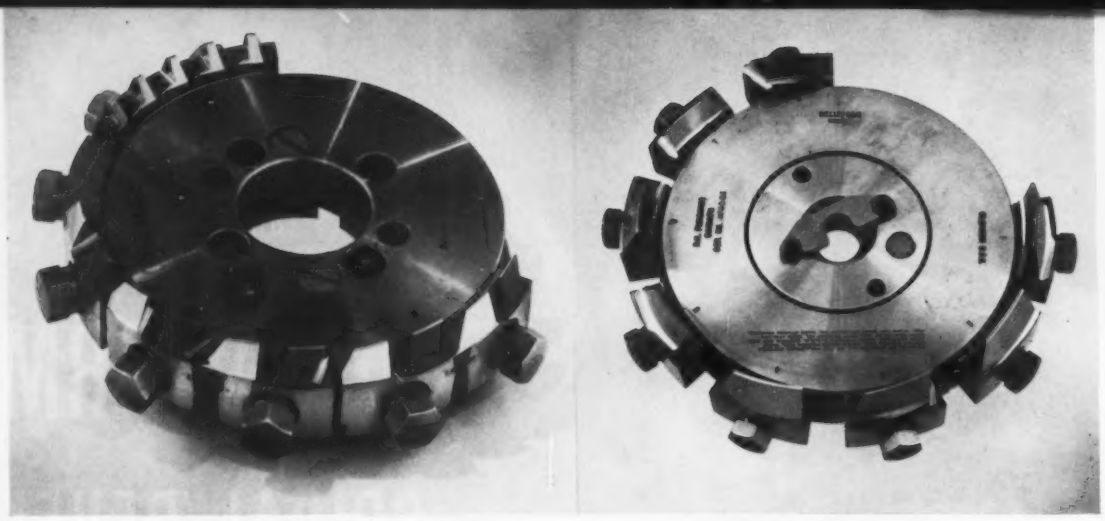


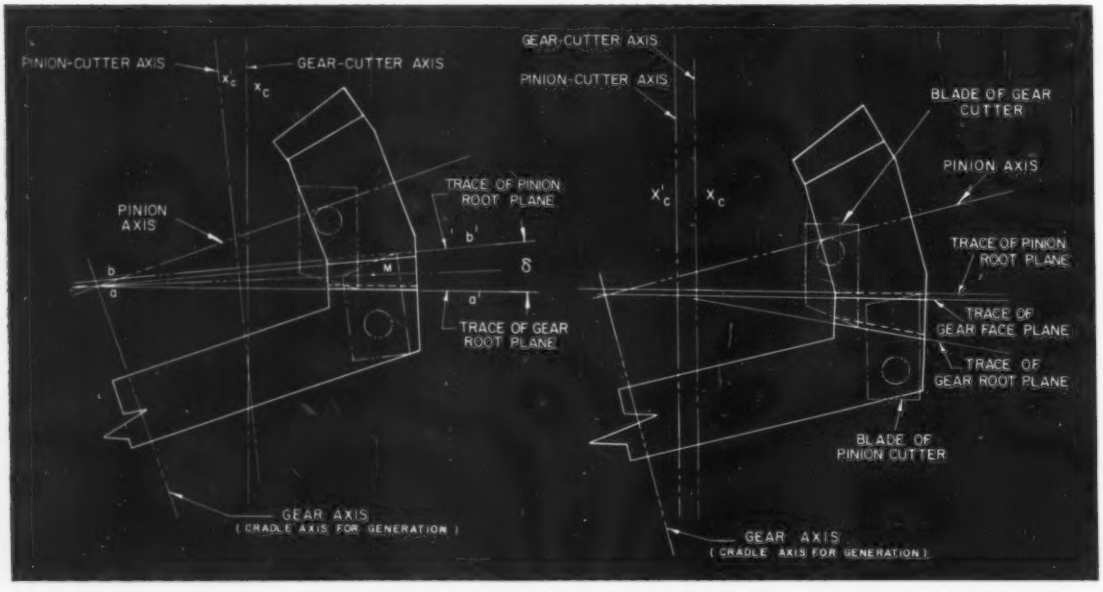
Fig. 1. Inserted-blade, face-mill type cutters are compared. The one at the left is designed to cut Formate gears; the one at the right is used for Helixform gears.

than indexing of the work-piece, the only motion involved is rotation of the cutter. Gear teeth thus produced are said to be non-generated. The pinion member, on the other hand, is generated to run with the gear.

The single-cycle tools generally used have inserted blades with straight cutting edges lying in a cutter axial plane. As the tool rotates, these cutting edges (which are coincident with the cone element) produce conical tooth surfaces of the Formate gear. Thus, face-mill type tools whose cutting edges describe cones as they rotate are called conical cutters. Such a tool can be seen at the left in Fig. 1. The blades with outside cutting edges produce the concave side of the curved teeth, while the inside cutting edges produce the convex side of the teeth.

With both Formate and Helixform setups, two basic datum planes are used. For the gear in a Formate setup the datum plane is tangent to the gear root cone, while for the pinion it is tangent to the pinion root cone. They are called, respectively, the gear root plane and the pinion root plane. At the left in Fig. 2, *a-a'* is the trace of the gear root plane; *b-b'* is the trace of the pinion root plane. Because spiral bevel and hypoid gears are usually designed with constant clearance, an element of the pinion face cone is parallel to the gear

Fig. 2. Formate setup (left) is compared with Helixform setup (right). In the former, cutter axes of pinion and gear are inclined; in the latter they are parallel.



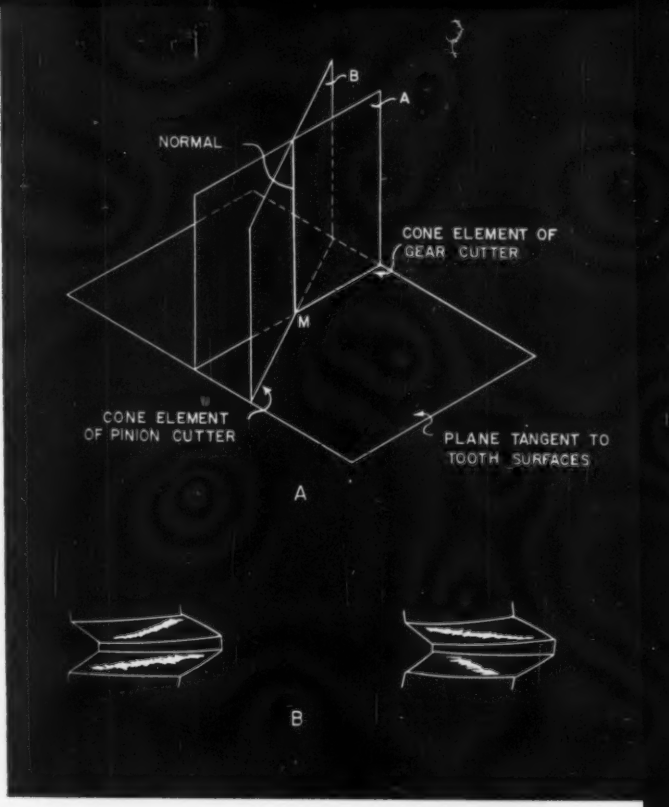


Fig. 3. Surface geometry and tooth contact of a Formate pair before bias correction. Different planes of cutter axes are shown at top, while inclined localized tooth bearing is shown at bottom.

root plane, and an element of the gear face cone is parallel to the pinion root plane.

A line perpendicular to the contacting tooth surfaces at a centrally located reference point *M*, called the mean point, is referred to as the tooth normal. Inclination of the tooth normal to the datum planes determines the root-plane pressure angles of gear and pinion.

If the cone angles of the gear cutter are made equal to the root-plane pressure angles of the gear, the gear-cutter axis *Xc* (left, Fig. 2) will be perpendicular to the gear root plane. In this position, the tips of the gear-cutter blades always lie in the gear root plane as they rotate. The conical surfaces of the gear teeth are thus defined by the position of the cutter and its cone angles.

It can be noted in the illustration that the pinion root plane is inclined to the gear root plane by an amount equal to angle δ. To produce teeth having the necessary depthwise taper, the blade tips of the pinion cutter must rotate in a plane tangent to that of the pinion root near the middle of the face. In the case shown (it has been assumed that the pinion cutter has a cone angle equal to the root-line pressure angle of the pinion) the pinion-cutter axis is perpendicular to the pinion root plane.

Gear-tooth surface, gear-cutter surface, and pinion-cutter surface all have a common normal at point *M*. But since axis *Xc* of the gear cutter is inclined toward axis *X'c* of the pinion cutter, they do not lie in a plane that contains both axes and the tooth normal. This means that the gear-cutter cone element at *M* does not coincide with the pinion-cutter cone element at *M*, although each element lies in a common plane that is tangent to teeth and cutters. At View A in Fig. 3 it is shown that the cutter axes lie in different planes, designated *A* and *B*.

With a suitable difference in cutter diameters, a pair of gears capable of running together with localized bearing would be produced. However, the bearing on the gear teeth would be inclined as in View B—such bearing being said to have "bias." This is an undesirable condition because, if deflected under load, the bearing would be concentrated near the top of the tooth, which would lead to early failure.

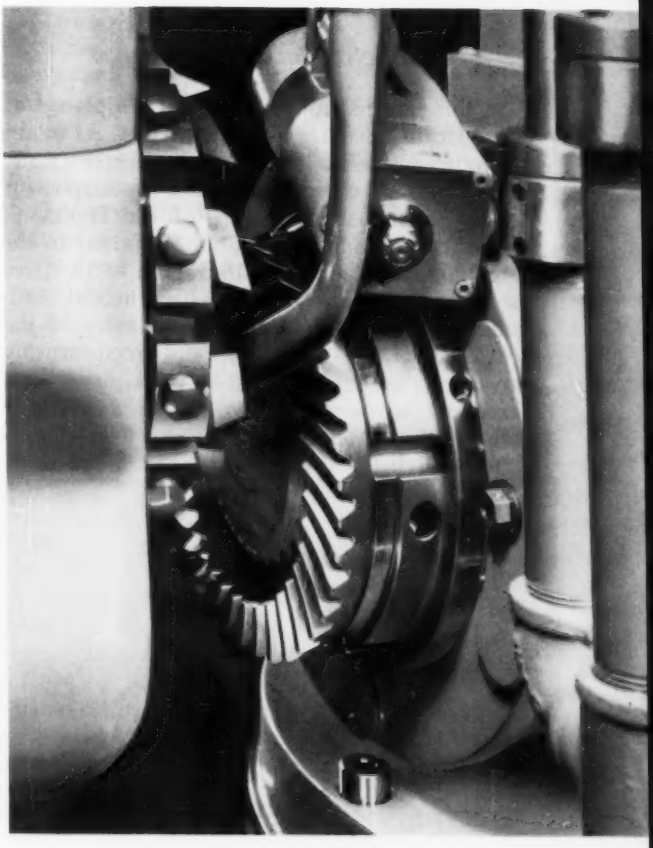


Fig. 4. Work area of a Helixform gear-finishing machine. Inserted-blade, face-mill type cutter at left completes both sides of a tooth space each revolution.

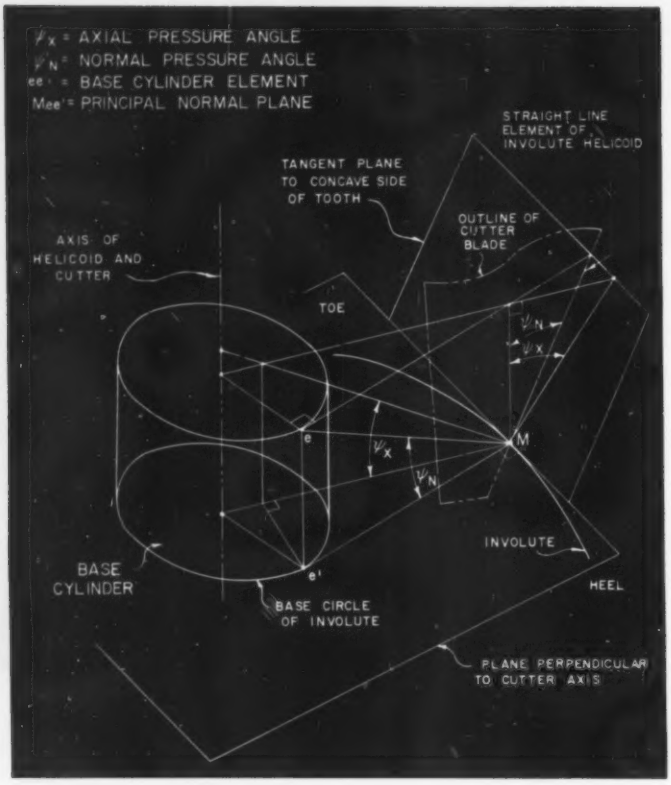


Fig. 5. Involute base cylinder and principal normal plane. The gear tooth has a changing radius of curvature, increasing from toe to heel on the concave side, and decreasing on the convex side.

The Helixform Cutting Method

In this process, rough-cut gears are placed on a Helixform finishing machine, Fig. 4. As in the Formate method, one turn of the cutter (right, Fig. 1) completes both sides of a tooth space.

The distinguishing feature of the Helixform method is an additional motion imparted to the cutter. As the blades pass through a tooth space the cutter is advanced axially by a helical feed-cam, then quickly returned before entry of the next blade. Thus, rotating and reciprocating movements are combined. The work-piece is indexed one tooth when it is in line with a gap between the cutter blades.

In the Helixform setup, right, Fig. 2, the gear-cutter axis *Xc* is perpendicular to the gear face plane. This is now possible because of the combined rotation and axial advance of the cutter, which places the path of the blade tips tangent to the gear root plane. Gear face plane and pinion root plane are parallel when gears are designed with constant clearance. It follows that, when cutter blade angles are made equal to pinion root-plane pressure angles, the gear-cutter axis is perpendicular to both pinion root plane and gear face plane. Therefore, axes of the gear and pinion cutters are parallel.

Blade edges of the cutter lie in the helicoidal surface, so that the gear-tooth surfaces produced are involute, or developable helicoids. It is possible to produce an involute surface with a variety of cutters, all differently ground, subject only to the requirement that the cutting edge lie in the involute helicoidal surface.

Assume that the pinion-cutter axis coincides with element *e-e'* of the base cylinder, Fig. 5, and that the straight cutting edge coincides with the straight-line element of the involute helicoidal surface. The pinion cutter then represents the tooth of a generating gear which is approximately the counterpart of the Helixform gear tooth.

Pinion-tooth surfaces produced by the Helixform method match those of the gear teeth. When lengthwise mismatch is slight, gears and pinions run together on test machines with the full tooth bearings of conjugate pairs. Even with substantial differences in cutter diameters, longitudinal localized bearings are obtained that are square and without bias.

It can be said that gears are produced initially without bias, having tooth surfaces close to true mathematical conjugacy. Flexibility of the process permits cutting of any of the conventional modifications in tooth shape that may be required by mounting, or to compensate for changes incurred by heat-treatment.

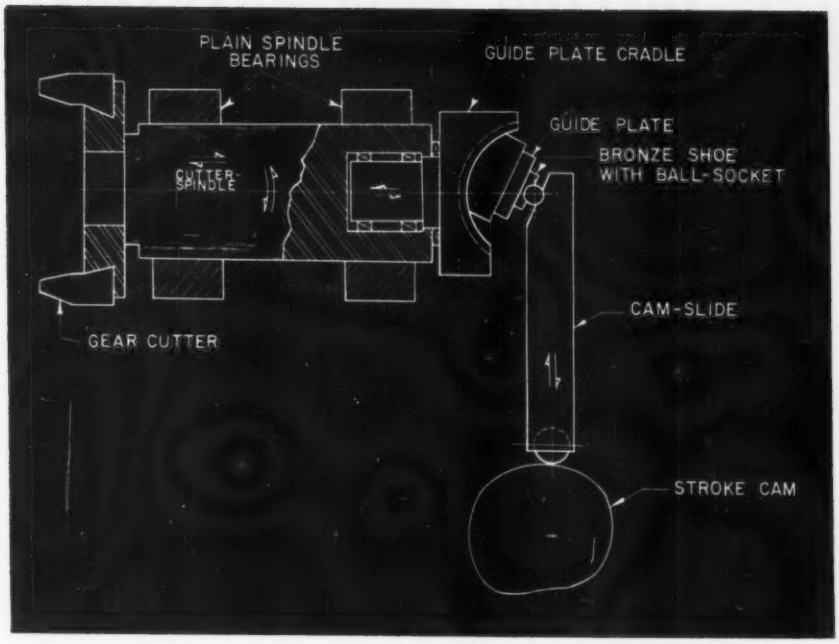


Fig. 6. Cutter-head mechanism of gear-finishing machine. Motion of the stroke cam is transmitted to the cutter-spindle by a cam-slide, a bronze shoe, and an adjustable guide plate and cradle.

A Word on Machine and Cutter Design

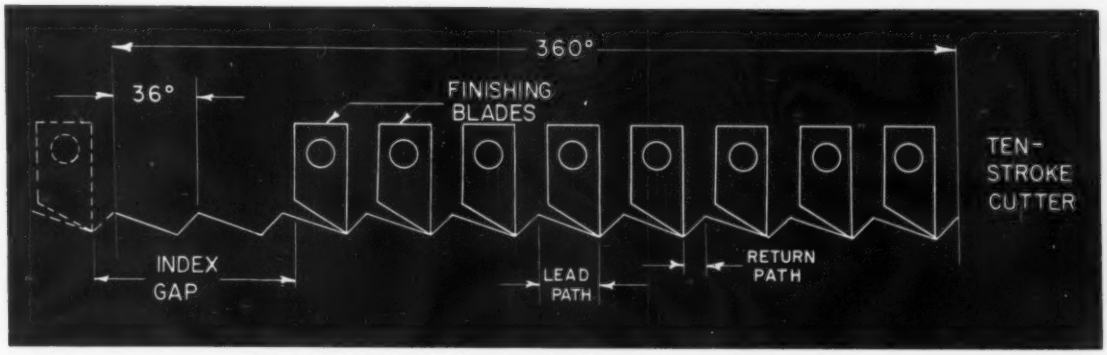
Understanding of the way in which the basic helical motion is derived necessitates consideration of the gear-cutting mechanism. The cutter-spindle of the Helixform gear-finishing machine reciprocates in a timed relationship with its rotation. A cam in the cutter head, Fig. 6, drives a slide which transmits motion to the cutter-spindle by means of an adjustable guide plate. The hardened-steel guide plate and its mating bronze shoe can be set to deliver up to 58 per cent of the uniform lead received from the cam.

Mounted in the work-head is a plate type index mechanism using a modified Geneva driver. Indexing takes place once for each revolution of the cutter—when a gap between the first and last blades is in a position to permit work rotation. During cutting, the work-spindle is hydraulically clamped to reduce the forces transmitted to the index mechanism.

Blades of a Helixform cutter are stepped in both radial and axial directions to take a precalculated chip load. Cutters are designed for either eight or ten strokes per cycle and have only one blade cutting at a time. The distance from the last finishing blade to the first semifinishing blade provides the index gap, Fig. 7.

Design of the gear to be cut will dictate the selection of the cutter type to be used. Generally, eight- and ten-stroke cutters may be used for more than one combination.

Fig. 7. Helixform cutters fall into one of two design classifications, depending on whether eight or ten strokes are used. Distance between last finishing blade and first semifinishing blade forms index gap.



"IMPOSSIBLE" MILLING NOW PRACTICAL

COLIN SHARP and LOUIS B. MAIN
Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence, R. I.

IN TODAY'S MACHINE SHOPS, parts that not many years ago were considered impossible to machine except by grinding are now being milled with reasonable success. Some operations on materials such as heat-treated alloy steels and heat-resistant steels are being done with high-speed steel cutters, particularly of the so-called "premium" varieties that are high in vanadium and cobalt. Cutting speeds are necessarily low, however, and feeds in fractions of an inch per minute are not unusual.

Cemented-carbide cutters, either tipped or solid, are now making it possible to mill the high-strength materials used for airplane landing-gear components and the new high-temperature alloys for jet aircraft and missiles. Cutting speeds of 100 sfpm (surface feet per minute) and over, and tooth loads up to 0.020 inch or more have been attained, resulting in feeds of several inches per minute.

Successful application of carbide cutters to these materials results in the need for certain refinements in milling machines, most of which may be made to existing equipment. As an example, the ability to climb mill is one of the prime requisites of equipment used for machining titanium, heat-treated alloys, and high-temperature-resistant alloys with carbide. Also, anti-friction bearings in the arbor support rather than bronze bushings have been found necessary to prevent failure or seizing due to the high cutting pressures.

A flywheel is of definite advantage in prolonging the life of carbide cutters. Small end-mills may be used successfully without a flywheel, but when milling with cutters approaching the size of the spindle bull gear, the shock of the tooth engagement and the following momentary hesitation require the steadying effect of an adequate flywheel. On large machines, the bull gear itself is of sufficient size to act as a flywheel for small- to medium-size cutters.

When milling titanium, stainless steels, and the high-temperature resistant alloys, coolant is desirable in quantity. Best results have been experienced with a spray mist, since the flow of air

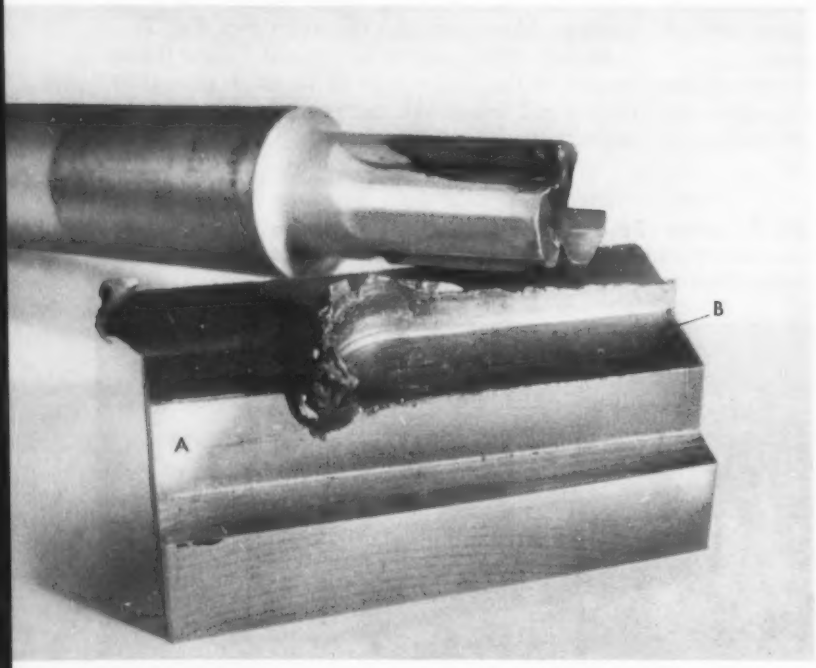


Fig. 1. Satisfactory finish on surface (A) was obtained by machining this piece of Type 304 stainless steel with the periphery of an end-mill. Rough surface (B) and chipped cutter teeth are the result of face-milling with the same end-mill (top).

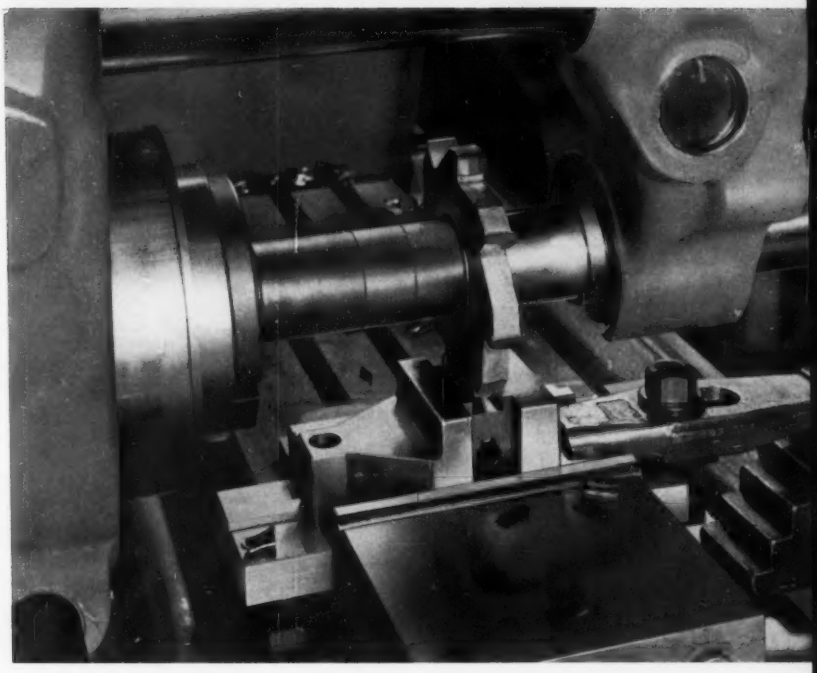


Fig. 2. Side mill with teeth having a negative radial rake and negative axial rake on each side being used to cut a 1/2-inch slot. The alloy steel work-piece had been heat-treated to a hardness of 55 Rockwell C.

helps to blow the chips off the cutter tooth. In any carbide application, the machine, fixture, and setup must be as free from spring as possible. Play or backlash in the machine should not be tolerated as it will induce early cutter failure due to chipping of the carbide. In addition, the power available should be sufficient to prevent stalling of the cutter.

The generally accepted idea has been that stainless steels can be machined by carbide cutters with some success only by face-milling and then only to a depth not exceeding the chamfer or face angle of the cutter. Recent experiences, however, prove that better results can be obtained by milling with the periphery of the cutter, as in slab milling. When milling stainless steel it is imperative to keep the chip cool. As soon as the chips start to change in color because of heat, they weld to the tooth face, and cutter failure is the result. The necessity for keeping the chips cool is contrary to the usual case in the milling of steels with carbide.

In a recent demonstration, a 1/2-inch diameter end-mill designed for aluminum was used to climb mill Type 304 stainless steel. This cutter had positive radial and axial rake angles of approximately 5 degrees. Several cuts 1/2 inch wide and 0.04 inch deep were made and the periphery of the cutter showed no noticeable wear. For this slab-milling operation, the cutter was rotated at 1240 rpm and the feed was 10 1/2 inches per minute. These operating conditions produce a chip load of about 0.003 inch per tooth. Later, the same end-mill was used to face-mill to a depth of 1/32 inch, employing nearly the full width of the cutter. Chips welded to the teeth after 3 inches of cut and the end of the cutter quickly became red hot. The results of both tests are shown in Fig. 1.

In another test, Fig. 2, AISI 4130 steel that had been heat-treated to a hardness of 55 Rockwell C was milled. A slot 1/2 inch wide by 0.200 inch deep was produced at a feed of 7 1/8 inches per minute using a 5-inch diameter carbide-tipped cutter running at 100 rpm. Since the side mill used had 8 teeth, the chip load per tooth was 0.009 inch. This cutter was of the Tri-Helix type and incorporated negative axial rake on both sides combined with a negative radial rake. A flywheel was unnecessary on this job due to the substantial size of the spindle driving gear. In making the cut, energy was consumed at a rate of approximately 9 hp. A light-oil coolant would have been added for production runs.

For titanium, carbide cutters of the aluminum cutting type with positive angles are recommended. In one test, very good results were obtained with a 6-inch diameter cutter rotating at 60 rpm while climb milling a slot 3/8 inch wide by 1/8 inch deep. A spray-mist coolant was used. Although a chip load of 0.005 to 0.006 inch per tooth is recommended to prevent the chips from sticking to the teeth, a chip load of 0.020 inch per tooth was attained. In another experiment, a two-lip end-mill was used for a cut 3/4 inch wide by 0.08 inch deep at a feed of 10 5/8 inches per

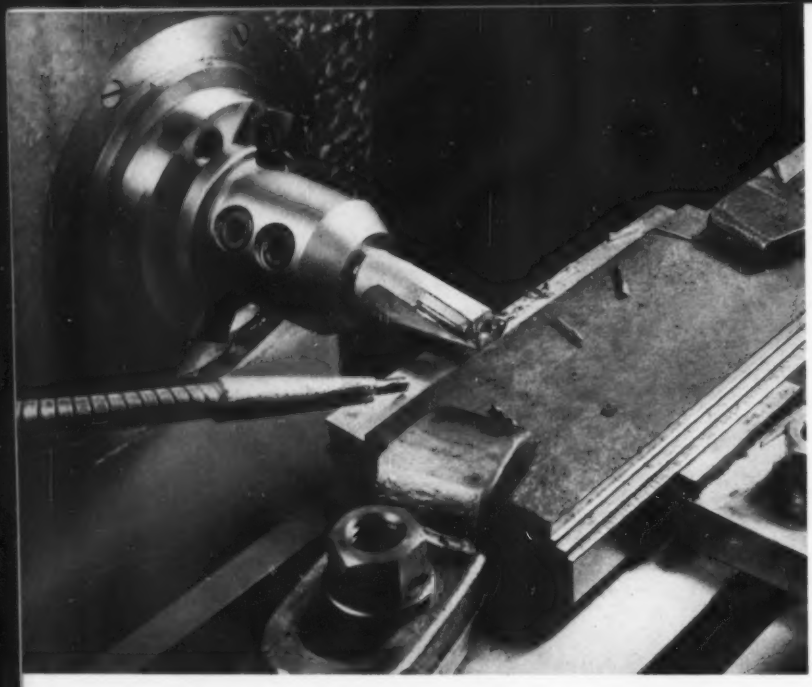


Fig. 3. This two-lipped, carbide-tipped end-mill is climb milling titanium. To prevent the chips from becoming welded to the cutter they are kept cool by a spray mist of soluble oil.

minute. The cut was taken at 635 rpm (145 surface feet per minute), resulting in an 0.0083-inch chip load per tooth. Again a spray mist of soluble oil was the coolant, and by climb milling, a satisfactory finish was produced. A number of the well-formed chips, which were not entirely blown off the work-piece, can be seen in Fig. 3.

Except for the machining of hardened AISI 4130 steel, all tests were performed on No. 2 knee type milling machines equipped with 7 1/2-hp motors and backlash eliminators on the table feed-screws. The AISI 4130 steel was cut on a bed type milling machine.

There is no question about the fact that the use of carbide cutters on those materials which are "difficult to machine" will permit much higher feeds and better production rates than can be obtained with high-speed steel cutters. Careful attention must be given to each application in order to prevent chipping the cutter. With correct conditions, however, materials previously considered "impossible" to mill become not so difficult.

Selective Plating Permits Fluxless Soldering

A selective plating technique allows aneroid elements of barometers, altimeters, depth gages, and other pressure-sensitive devices to be soldered without flux. Developed by Dalic Metachemical Ltd., Toronto, Canada, the method eliminates the chance of leaving corrosive material inside of the diaphragm. Usually, the oxide film on heat-treated diaphragms is ground or lapped off and the edges tinned for soldering. Even the slightest amount of flux left behind may cause internal corrosion and subsequent leakage.

Hand cleaning and possible mechanical damage are avoided by deoxidizing the diaphragms electrolytically and then rinsing them. Mating surfaces are immediately plated with a flash coat of tin, or tin-lead alloy, which permits soldering without flux. The halves should be joined within a few days, because the tin or tin-alloy deposit will age, making it difficult for the solder to wet the surface. When parts are to be stored for longer periods prior to soldering, a flash coat of gold is preferred. A second method eliminates not only the flux, but manual soldering as well. After cleaning, 0.0005 inch of tin or tin-lead alloy is deposited on each contact edge. The diaphragm halves are then clamped together and sent through a controlled-atmosphere oven at 500 degrees F. An exposure of five minutes in this oven achieves a strong, leakproof seal. Selective plating techniques and solutions may be used on diaphragms of many other metals.

In selective plating, the cathode lead from a special rectifier is clamped to the diaphragm and the positive lead is connected to a graphite anode in a stylus. After wrapping the graphite with long-fiber cotton, and saturating it with the proper electrolyte, the wet stylus is passed over the exact area to be plated. Finely controlled and sharply defined deposits are thus obtained without extensive masking. In addition, with a quick change of anode and solution, almost any metal can be deposited on any other.

AUTOMOTIVE STEERING LINKAGES

—more to them than meets the eye

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A SLIGHT TURN of the steering wheel—a corresponding change in direction of the family car. To most drivers this is a routine function and the mechanics behind it are apparently simple enough. But it is a complex system of linkages that translates the smallest movement of the steering column into a correlative movement of the front wheels.

An idea of the intricacy of such a system can be had by referring to Fig. 1. Illustrated, in exploded form, is but one section of a typical steering-linkage assembly being manufactured at the Van Dyke, Mich., plant of Thompson Products, Inc., for current-model automobiles. The main, and largest, part in the illustration is the center link shell denoted at *A*.

Depending on the destination of the assembly, steering-linkage components are either forged from the solid or shaped and welded from tubing. However, manufacturing methods to be described will deal only with the forged variety.

Sheared Blanks Routed by Automatic Conveyor System

Blanks for the center links are cut from 7/8-inch diameter bars of SAE 1038 hot-rolled steel. The 16-foot-long bars are stacked along an inclined vibrating magazine that drops them, one at a time, on power-driven feed-rolls. Rotation of the feed-rolls carries the bars lengthwise through the open jaws of the Canton (Hill Acme) alligator shears shown in Fig. 2. The end of the bar butts against a stop-plunger on the far side of the shear, opening a switch in the feed-roll circuit and tripping the shear blade.

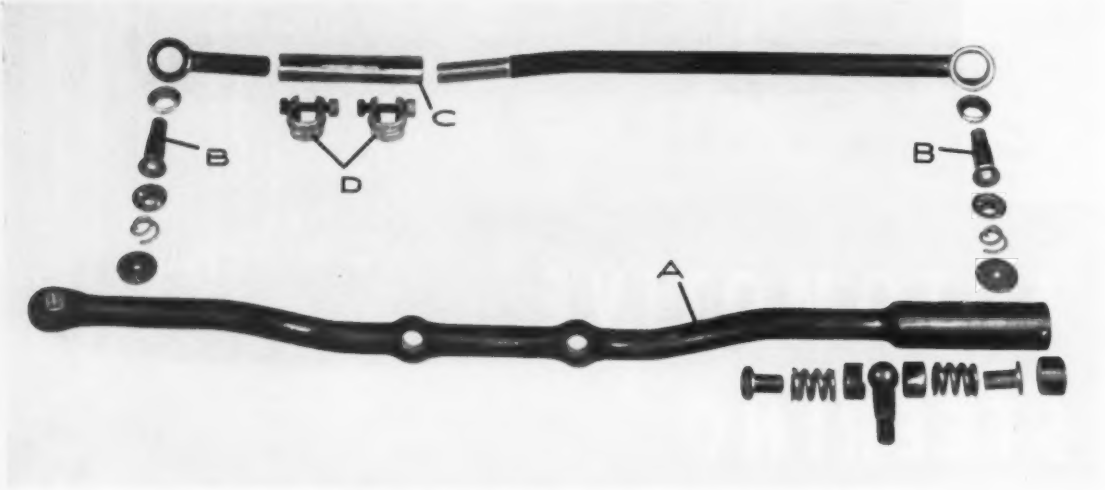

Fig. 1. The intricacy of steering-linkage systems can be realized from this exploded view. Shown is but one section of a standard linkage system.

Cut blanks are removed from the shear by hand and deposited in the triangular-shaped bucket at the lower left-hand corner of the illustration. When the bucket is full, the operator depresses one of several selector buttons on a control panel. This causes the bucket to be elevated to the level of the overhead conveyor system along which it travels to the proper workstation.

Loaded buckets are delivered to one of four upsetting presses. Because each of the four installations is handling a different job, each bucket must be directed to its correct location. This is handled automatically by an intricate power-and-free conveyor system suspended above the forging and raw material areas of the plant.

In the basic power-and-free system, two main lines are employed. A power line, consisting of a continuous-chain trolley conveyor, follows above a free line, or track. Branch lines lead off from the main free track and the bucket carriers can be switched onto them to feed various parts of the shop.

When the elevator unit (left, Fig. 2) has completed its ascent between the two vertical rails, the free trolley supporting the bucket carrier is in line with the lower (free) track of the conveyor system. One of many pusher-dogs protruding below the power line engages a carrier-arm extending from the top of the free trolley. By this means the loaded bucket is propelled along the main conveyor line.

Selector buttons on the operator's control panel actuate switching devices at the point where their respective branch lines intersect the main free track. When the bucket carrier reaches the designated branch, its free trolley is switched from the main line and coasts down a slightly inclined path to a storage track above the machine to be serviced.

Six waiting buckets—representing approximately a two-hour supply of blanks—can be accommodated by each storage track. It sometimes happens that a bucket is sent on its way from the cutoff shear (Fig. 2) and is directed to a branch line on which the storage track is already filled. In this case, an interlock on the storage track over-controls the switching device and the moving bucket is bypassed. This extra bucket will continue to circle the main line until it can be accepted at its assigned destination.

Localized Heating Prepares Blanks for Upset-Forging

A full bucket is lowered from the first position on the overhead storage track, which is directly above the loading magazine shown at the left in Fig. 3. After nesting in a funnel-shaped hopper, the bottom of the bucket opens and the 30 5/8-inch lengths of steel rod discharge into the magazine. They can be seen stacked at *E*. Immediately ahead of the magazine is a Tocco induction-heating unit having two coils, one being the white object denoted at *F*.

Steel blanks are automatically advanced from the magazine into the induction coils. To avoid a sudden peaking of electrical load followed by a complete drop on the high-frequency generator, the coils are loaded and energized alternately. This permits the current to be directed from one coil to the other when the heated blank is removed.

As only the two middle bosses of the center

link are to be formed in this operation, localized heating is desired and the coils surround only the affected area. Although each induction coil is a single physical unit, it is divided into two electrical sections corresponding to the areas around the two bosses. The effect of this can be noticed on the heated blank.

At the conclusion of a pre-set heating cycle, the blank is ejected from the coil. It rolls down the inclined ramp at *G*, Fig. 3, and comes to rest against two angle-iron stops.The operator grabs the heated blank with a gloved hand, slips a socket type holder over the back end, and quickly swings it into position at the 2-inch National upset-forging machine seen at the right in the illustration.

Multiple passes are made to fully shape the two center bosses. The operator positions the blank for each pass by butting the back end of the socket holder against a stop that is supported on an outrigger.

During the first pass the metal is gathered at the two boss areas in a sliding type die. As the die members close, the blank is gripped securely. The header ram then applies pressure against the end of the blank, forcing the plastic metal areas to assume the shape of the die cavities.

It is during this first pass that the advantage of the split-section induction-coil design is realized. The two white-hot areas of the blank are considerably more susceptible to plastic deformation than is the dark-red band that separates them. Therefore, gathering takes place in the predetermined locations.

The blank is next shifted to the first of the flattening positions in the die (located below the gathering position) for the second pass. Final flattening is performed during the remaining passes at the lower die positions. These steps are completed in far less time than it takes to tell: all forging passes are accomplished in one heating of the blank. A conveyor then carries the blanks through an overhead cooling cabinet. Water sprays are directed against the hot parts, cooling them sufficiently for handling.

Using another Tocco induction unit, the end of the link requiring the eye boss (left-hand end, *A*, Fig. 1) is brought to a white heat. In an adjacent 2-inch National upset-forging machine the eye end is formed in two passes: the first, gathering; the second, flattening.

A third and last hot-forging operation shapes the opposite end of the center link. The blank is removed from an induction coil and placed between the dies in a 2 1/2-inch National upsetter where the socket end is completed. As in the previous two forging operations, the first pass is used to gather the hot metal into the approximate shape of the 1 5/16-inch diameter by 4 1/2-inch-long socket. A 1-inch diameter axial hole is to be provided to a depth of about 4 inches. This is done in stages by piercing punches during the remaining passes. Socket trimming is the function of the final die position.

With the exception of the upset areas, the center link is, by and large, straight. Its specified contour is acquired during two cold press operations. In the first of these, the center bosses are coined and the work-piece is partially bent on a 150-ton Toledo press. In the second, the eye end is coined and the necessary bends are completed on a 150-ton Bliss press.

Machining Center-Link Forgings

Several machining steps are required on the center-link forgings. In the first operation an 0.853-inch diameter hole is drilled through the eye boss on the Davis & Thompson "Roto-Matic" drilling machine shown in Fig. 4. One forging is accommodated at each of twelve stations, with a production rate of more than 800 pieces per hour being obtained.

An operator can be seen placing a work-piece in a fixture at the loading station. The eye boss is banked against two upright locating pins at

Fig. 2. Automatic shear cuts steel blanks for center-link forgings (A), Fig. 1. Bucket on elevator at left is part of a complex power-and-free conveyor system.

Fig. 3. (Right) Upset-forging of two center-link bosses. Blanks are fed from the magazine at the left to induction coils (F) for localized heating.

Fig. 4. (Below) Eye bosses of center links are drilled on this twelve-station machine. Forgings float in the fixture, being temporarily located and clamped by a spring-loaded head beneath the quill.

the inner end of the fixture. Extending from the outer end of the fixture is an outrigger having two vertical jaws. The rear portion of the center link nests in the channel-shaped opening between these jaws, but is not clamped.

Three tapered locating lugs protrude from the bottom surface of a spring-loaded clamping head (one such head can be seen at *H* in Fig. 4). As the machine table indexes from station to station the quill lowers, carrying the clamping head beneath it. When the locating lugs contact the periphery of the eye boss they bring the floating center link into alignment with the drill spindle, and downward travel of the clamping head is arrested. However, the drill spindle continues its feed movement, compressing the heavy coil springs above the now stationary head which, in turn, applies firm clamping pressure against the forging. A guide bushing for the drill is contained in this head.

Unloading is automatic. Indexing of the machine table at the last station causes the center-link socket to ride up on an inclined plate *J*. At the same time, the clamping head retracts to free the eye boss. As the socket continues along the inclined plate it is lifted clear of the fixture and drops into a discharge chute leading to a tote box. An interesting feature of these fixtures is that they are not restricted to but one size of center link. The outriggers are adjustable both as to the distance they extend from the main fixture body and to the spacing between the two vertical jaws.

One of the follow-up operations is tapping obtuse-angle threads, having a 0.0909-inch pitch, through the eye boss on a special, company-built, vertical tapping machine. Some others are drilling 33/64-inch diameter holes through the two center bosses on a bank of Baker drilling machines, and taper-reaming the same holes (1 1/2-inch taper per foot) on a second group of Baker machines.

Oxidized skin is removed from the forged socket hole by reaming on one of four Ex-Cell-O machines. Each horizontal machine has four heads that are arranged in two opposed pairs. During this operation the holes are finished to a diameter of 1.007 inch and the socket end is faced and chamfered. Later, a 1 1/16-18 NEF 2B thread is cut 1 inch deep on a Reeves four-spindle, horizontal tapping machine.

To permit lubrication of the movable parts that will be contained by the socket a standard grease fitting is provided. A raised seat for the fitting is extruded through the socket wall, Fig. 5. In preparation, the area to be extruded is brought to an

elevated temperature. The forging is supported by V-blocks at one of two positions on the stand shown to the left of the operator. At the head of the stand are two Weldit torches that heat a small area of the socket.

When the proper temperature has been reached, the forging is picked from the stand and transferred to a piercing die on the illustrated 6-ton Denison Multipress. The punch passes through a keyhole-shaped ball stud opening in the upper wall of the socket and strikes the inner surface of the lower wall. In piercing this lower wall, the shaped punch extrudes a neck outward. (Neck extrusion is done after the socket hole is reamed, but before it is tapped.)

Production Highlights of Other Steering-Linkage Components

There are other operations of interest besides those performed on center-link forgings. Ball studs, for example, are contour-turned, threaded, cross-drilled, then hardened all over. It is required, however, that the threaded portion be in a soft condition. To achieve this, the ball studs undergo continuous localized annealing on the Tocco induction-heating machine illustrated in Fig. 6.

Hardened ball studs, such as those indicated at *B* in Fig. 1, are stored in a bin at the base of a May-Fran elevator unit (right, rear). They are carried to the top of the elevator and dumped into a rotating hopper above and behind the machine. The hopper orients the parts and guides them into a short, inclined feed chute. From the bottom of the feed chute the studs fall against the ends of spring type gripping fingers that radiate from a large rotating fixture wheel.

Continued movement of the fixture pulls the ball studs against a tapered bar that snaps them into V-notches between the gripping fingers. At the left of the machine the threaded ends pass between the walls of a curved, channel-shaped induction head, Fig. 7, and are brought to a red heat. Further along, after air-cooling for a short period, the studs pass through a quenching head where sprays of water strike them.

After leaving the quenching position the studs contact a stationary tapered finger and are forced

Fig. 5. (Above) A raised seat for a grease fitting is provided in the socket end of the links. Socket wall is heated locally (stand at left of press), then extruded outward.

Fig. 6. (Left) Threaded ends of hardened ball studs are being continuously annealed on this automatic induction-heating installation. The fixture wheel accommodates seventy-five parts.

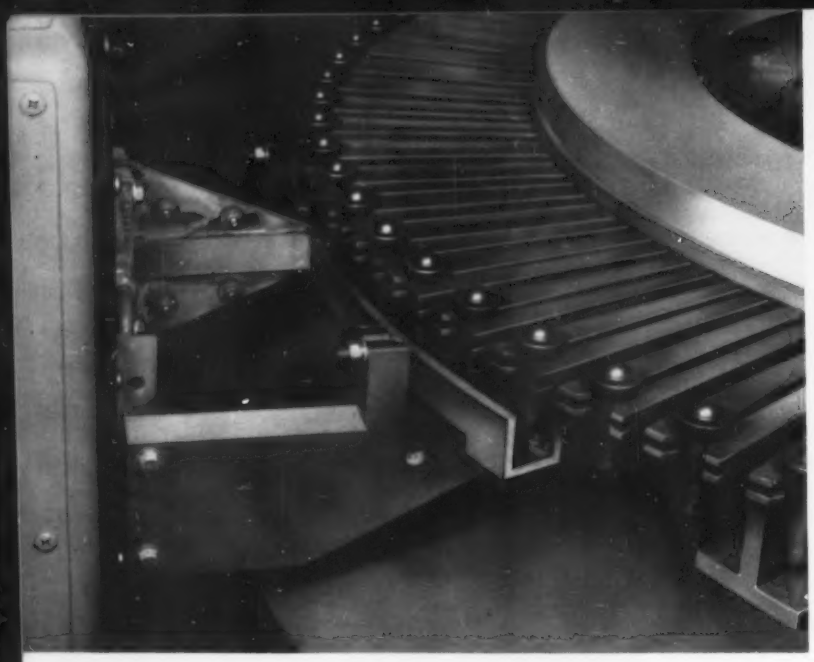

Fig. 7. Ball studs are held between gripping fingers as they pass through this channel-shaped induction head (left, Fig. 6). After a brief period of air-cooling, the studs undergo water-quenching.

out of the fixture. They drop down a small chute to a waiting tote box. The fixture wheel contains seventy-five stations, with annealing being carried out at the rate of several thousand ball studs per hour.

Stamping, Threading, and Assembly of Wheel-Alignment Turnbuckles

Turnbuckles are an important part of the linkage chain, being used to facilitate alignment of the front wheels. As might be expected, the threads at each end of the adjusting sleeve are of opposite hands. An adjusting sleeve can be seen at *C* in Fig. 1, and also in Fig. 8.

Sleeves are stamped from 4 1/2-inch-wide coils of 1/8 inch thick, SAE 1025 hot-rolled steel. This is done on the 150-ton Bliss open-back, inclinable press shown in Fig. 9, using a three-station progressive die. Blanking is accomplished at the first station, with a U-shape being formed at the second station. The partially formed part then slides down a short rod (sloping to the rear because of press inclination) to the third station which is directly behind the second. On the down stroke of the press, horizontal slides curl the straight sides to form the cylindrical workpiece.

Completed sleeves are ejected into a chute and pass down to a storage bin. Should this bin be full, the flow of parts is directed into an auxiliary chute leading to an overflow storage receptacle.

An elevator raises the adjusting sleeves from the storage bin and dumps them into the inclined chute that can be seen at the operator's left in Fig. 10. This is an eight-station (sixteen-spindle) Crestline automatic tapping machine.

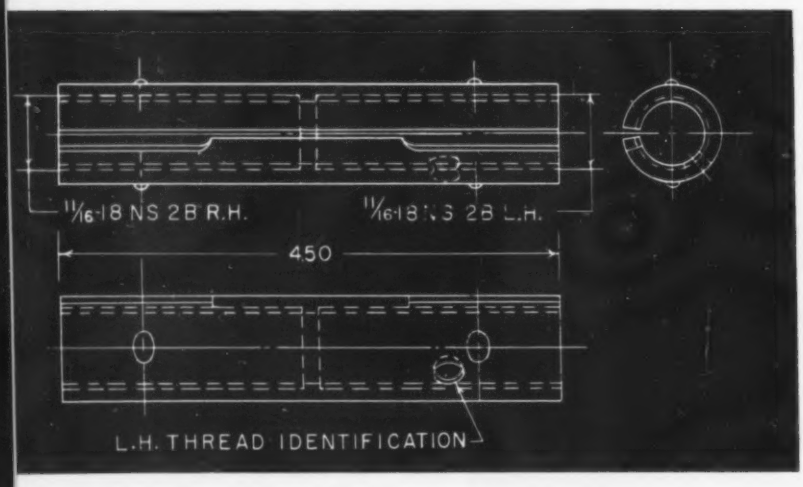

Fig. 8. This adjusting sleeve will be part of a turnbuckle assembly. Threads at each end are of opposite hands. A small hole at one end identifies the left-hand thread.

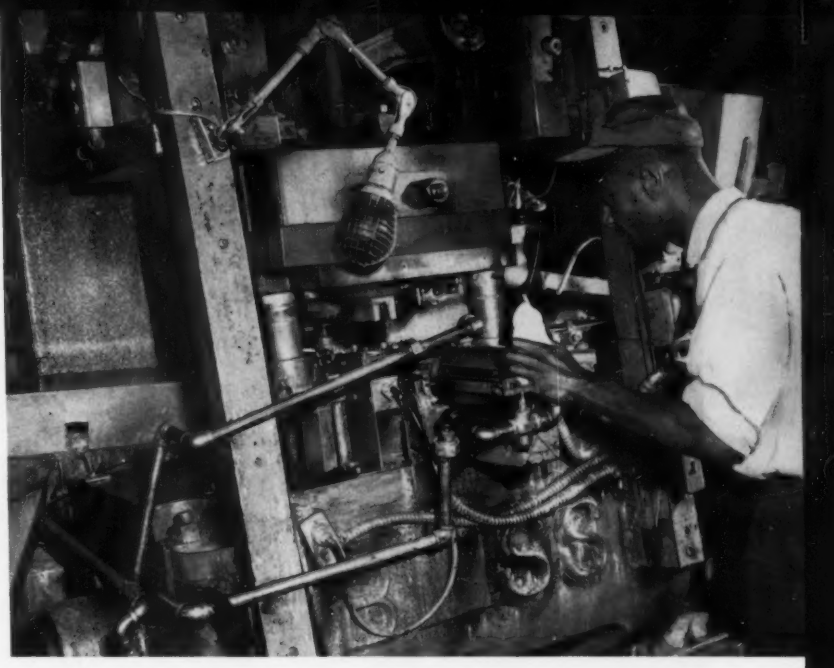

Fig. 9. Adjusting sleeves (Fig. 8) are manufactured on this 150-ton press. A three-station progressive die first blanks, then forms to a U-shape, and finally curls to a cylindrical shape.

One of the two spindles at each station drives a right-hand tap, the other, a left-hand tap.

Left-hand threads are provided in the end of the sleeve having an identification hole (Fig. 8). Proper orientation is the responsibility of the operator who feeds the loading magazine as shown in Fig. 10. Parts are placed in two adjacent channels of the magazine—one channel receiving parts with the identification hole up, the other with the hole down.

From the bottom of the magazine the parts drop onto vertical pins which raise them into place in a dual holding fixture. An open fixture approaching the loading station is denoted at *K*. A hydraulic cylinder fixed to the machine frame drives a steel lever against the end of lock-rod *L* that projects horizontally from below the fixture. This blow sets Cleveland locks that hold the fixture in a closed position throughout the machining cycle.

As the operating sequence progresses, the spindles feed out and the two taps enter the adjusting sleeves. When the spindles have retracted, the fixture automatically indexes 180

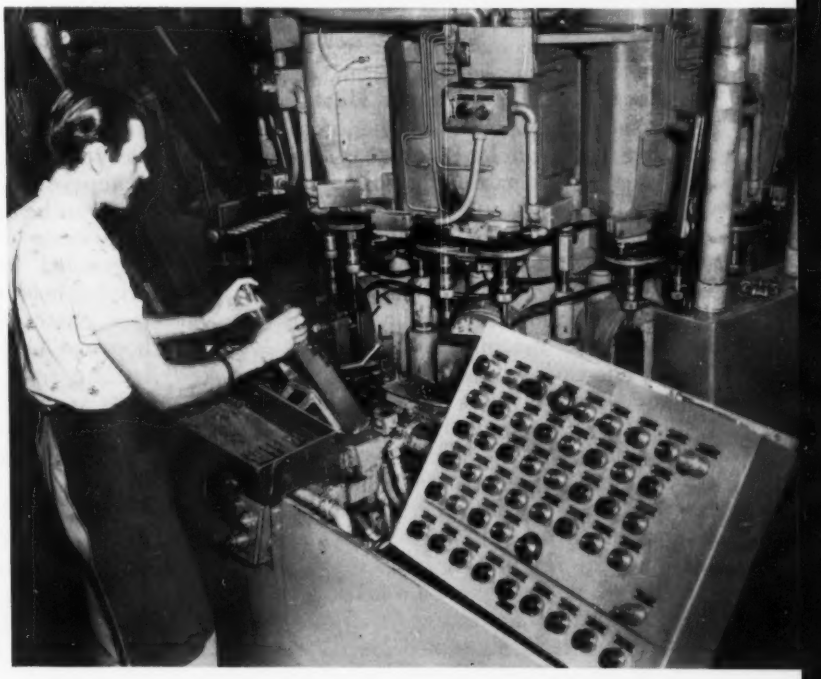

Fig. 10. Automatic tapping machine for adjusting sleeves. Right- and left-hand taps thread two parts at each station. Fixtures rotate 180 degrees to present opposite ends to the taps.

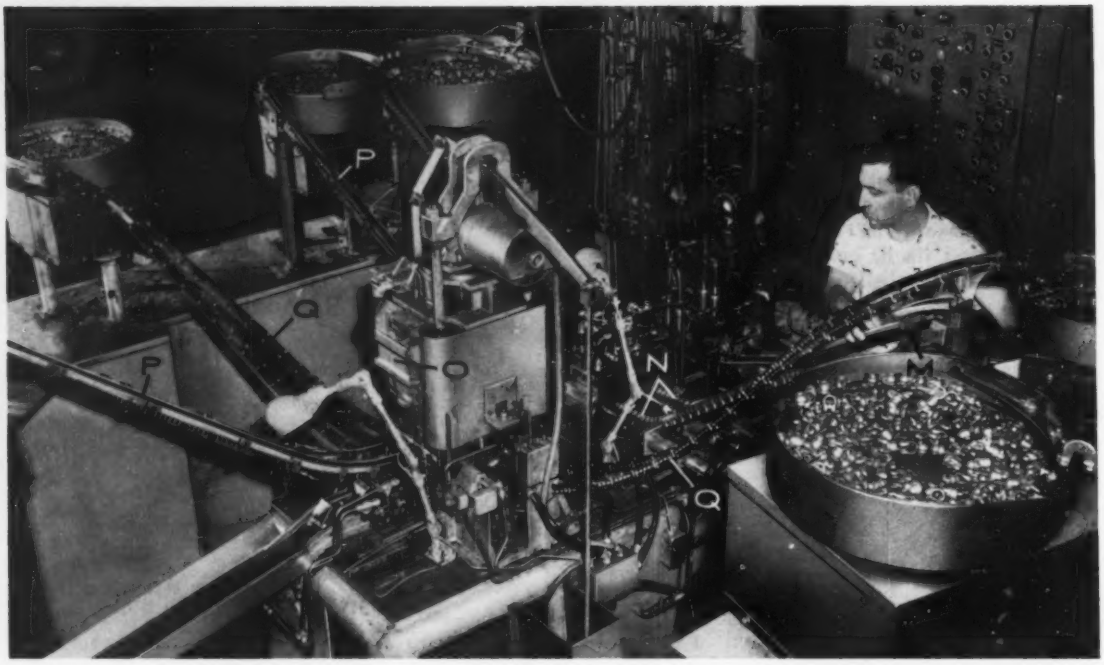

Fig. 11. Turnbuckle parts are assembled on this automatic machine. Shuttles orient and align clamps and sleeves before they are pressed together. Head (O) drives bolts through clamp holes and into nuts.

degrees to present the opposite sleeve ends to the taps. In this way, the work-piece that initially received the right-hand threads is now inverted and positioned beneath the left-hand tap, and vice versa. Another infeed and retraction of the spindles completes the operation.

Steel fingers actuated by a second hydraulic cylinder grasp the lock-rod *L* at the unloading station and pull it outward. This unlocks and opens the fixture, permitting the threaded sleeves to drop into a discharge chute. Cleaning is the final step for this part and is done in a Cincinnati washing machine.

Two clamps (*D*, Fig. 1), which have been stamped and formed on a U. S. Multi-Slide machine, are placed on the adjusting sleeve to complete the turnbuckle assembly. This is done on an automatic machine built by the Mercury Tool & Die Co. and illustrated in Fig. 11.

Four different parts must be handled: adjusting sleeves, clamps, bolts, and nuts. Because two turnbuckles are assembled simultaneously, two chutes are required to feed the housings and four chutes are required for each of the other components. All but the sleeves are oriented and fed by Syntron vibrating hoppers.

Sleeves ride in two hand-loaded chutes *M*, Fig. 11, to a pair of fixtures carried by a conveyor chain. They are firmly seated from above by two hydraulic rams, and are rotated to correct assembly position by screwdriver type tools driven by reciprocating racks.

Two rows of clamps *N* are fed to each side of a shuttle unit straddling the fixture conveyor. This unit advances to the next station, during which movement the clamps, too, are oriented for assembly. At this point the four clamps and the two sleeves are aligned. Hydraulic cylinders above the conveyor apply holding pressure to the sleeves while four horizontal rams press the clamps over the small spherical protuberances that can be seen in Fig. 8.

Advance of the fixtures brings the partially assembled turnbuckles beneath a four-spindle driving head *O*, Fig. 11. Feeding this station are four chutes *P* leading from two vibrating bolt hoppers, and four Lamb FabriFlex chutes *Q* leading from two vibrating nut hoppers. The bolts are positioned above the clamp holes and the nuts are positioned below.

V-fingers locate the nuts and also restrain them from turning as the four spindles engage the hexagonal bolt heads and drive them home. In the event of excessive pressure build-up during tightening, the spindles will slip, causing the entire machine to shut down. Operating at full capacity, this installation can assemble more than one thousand turnbuckles per hour.

Taper Errors Caused by Incorrect Tool Settings

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THE IMPORTANCE of setting the cutting tip of a tool accurately in the same horizontal plane as the center of the work-piece when producing tapers is well known. In this article the numerical relationships between the inaccuracy of setting the tool and the ensuing errors in the shape obtained are discussed.

Consider first the geometry involved in the generation of external tapers by turning. Assume that a lathe has been set up to produce a taper with an included angle of $2a$. The cutting tool should move along a straight line at an angle a to the axis of the taper. This is true whether the taper is produced by means of a taper-turning attachment, by offsetting the tailstock, or by pivoting the lathe compound.

The effect of incorrectly setting the tool is shown in Fig. 1. The distance y of the tool tip from the vertical center line of the work-piece is linearly proportional to the length x of taper as measured from the apex: $y = x \tan a$. Moreover,

$$r^2 = y^2 + h^2$$
$$= x^2 \tan^2 a + h^2$$

where

h = effective error in setting the tool tip

r = radius of the tapered part at x (1)

The generated shape is the function obtained by dividing Equation (1) by h^2 or

$$\frac{r^2}{h^2} - \frac{x^2}{h^2/\tan^2 a} = 1 \quad (2)$$

This is an equation of a hyperbola and means that the error in setting not only changes the dimensions of the taper but also distorts the straight-line generatrix of the shape produced into a hyperbola.

When grinding an external taper, the wheel usually has a diameter several times greater than that of the work-piece. As a result, the effect of a setting inaccuracy in grinding is considerably less than in turning. The geometry of this case is shown at A in Fig. 2.

$$\frac{h}{H} = \frac{r}{r + (D/2)} = \frac{d}{d + D}$$

where

h = effective error in setting wheel
H = actual error in setting wheel
$d = 2r$ = work-piece diameter
$D = 2R$ = grinding-wheel diameter

The equation of the generatrix remains

$$\frac{r^2}{h^2} - \frac{x^2}{h^2/\tan^2 a} = 1$$

but h is now a function of the radius r of the work-piece which changes with its distance x from the apex. Since, however, the majority of tapers in engineering are not steep, r may be regarded as a mean radius of the taper. Again, the generated shape is not a straight line but a hyperbola, though slightly different in form from the previous one. The effective error in setting a grinding wheel, however, is much smaller than the actual one and the error of the shape obtained will be considerably less than that obtained in turning.

There is no geometrical difference between turning external and internal tapers. The deflection of the boring bar, however, may cause additional errors similar to those resulting from inaccuracies in tool setting.

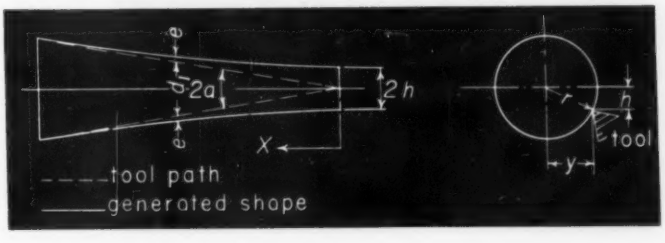

Fig. 1. In taper turning, a tool set below center will not generate a true cone. The resulting surface is a hyperboloid of revolution.

In the case of internal grinding, the geometrical relationships are somewhat different. As shown at B in Fig. 2, the effective tool-setting error h is larger than the actual error H. If $r = d/2$ is the taper radius and $R = D/2$ is the grinding wheel radius, the relationship obtained is

$$\frac{h}{r} = \frac{H}{r - R} \text{ or}$$

$$\frac{h}{H} = \frac{1}{1 - D/d}$$

Values of the ratio h/H for various diameter ratios D/d are shown in the graph in Fig. 3. It is evident that h will always be larger than H and, in a case of a grinding wheel having a diameter approaching that of the taper, the effective error in setting may be many times greater than the actual error.

Permissible errors in setting tools on center can be determined by mathematical relationships. When turning an external taper, if the machine is set to the proper angle a and the resulting diameter at the large end is correct, all other diameters along the taper will be larger than those required. The error e of the radius r will then be (Fig. 1)

$$e = r - \frac{d_1}{2}$$

where d_1 = desired diameter of taper

Since

$$r^2 = h^2 + \left(\frac{d_1}{2}\right)^2$$

$$h^2 = r^2 - \left(\frac{d_1}{2}\right)^2$$

$$= \left(r + \frac{d_1}{2}\right)\left(r - \frac{d_1}{2}\right)$$

$$= \left(r + \frac{d_1}{2}\right)e$$

and as r approximately equals $\frac{d_1}{2}$, the equation can be rewritten as:

$$h^2 = ed \text{ or}$$

$$e = \frac{h^2}{d} \qquad (3)$$

If e is the value of the maximum permissible error on the radius of the taper, the required accuracy in height for setting the tool is given by

$$h \leq \sqrt{ed} \qquad (4)$$

This equation is also applicable to the turning of internal tapers.

In grinding, Equation (3) can be used by expressing h in terms of d and D

$$e = \frac{H^2 d^2}{d_1(d + D)^2}$$

As d is usually much smaller than D, however, it is permissible to say that $d + D$ approximately equals D and

$$e = \frac{H^2 d^2}{dD^2} = H^2 \frac{d}{D^2} \qquad (5)$$

The required accuracy of setting in this case is therefore given by the equation

$$H \leq \frac{D}{d} \sqrt{ed} \text{ or} \qquad (6)$$

$$H \leq D \sqrt{e/d}$$

Similarly, Equation (3) can be used for determining tool-setting errors when grinding internal tapers.

By expressing h in terms of d and D,

$$e = \frac{h^2}{d} = \frac{H^2}{d\,(1 - D/d)^2}$$

Fig. 2. Relationships existing between actual (H) and effective (h) grinding-wheel setting errors for both external- and internal-taper grinding.

The permissible error in setting H for a permissible maximum error e of the taper will then be

$$H \leq (1 - D/d)\sqrt{ed} \qquad (7)$$

A departure from a straight line is not considered in the tolerances given for deviations of tapers. Although the effects of curvature on the "gripping" capacity of a tool-shank taper do not appear to have been investigated, it is possible to compare the average taper error with the prescribed limits.

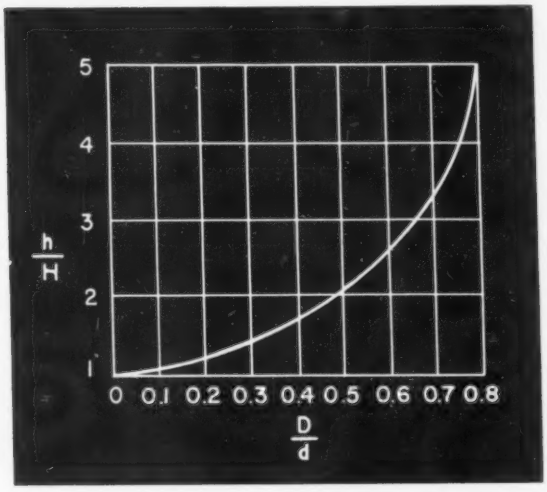

Fig. 3. Plot showing how the ratio of effective to actual wheel setting error (h/H) varies with the wheel to work diameter ratio (D/d) for internal grinding.

The average error per unit length in a taper of the length L is $2e/L$, as shown in Fig. 4. Therefore, for machining a tool shank with a Morse taper 4 inches long, having a tolerance of ± 0.0005 inch per inch on the taper, the tolerated error would allow a diametral error at the small end of $\pm$ 0.0005 $\times$ 4 or $\pm$ 0.002 inch. For the purpose of this investigation only the + 0.002 inch value is significant and as this is equal to $2e$, e = 0.001 inch. For a diameter of 1 inch at the small end of the taper, the maximum permissible setting error h of the tool is given by $h = \sqrt{ed} = \sqrt{1/1000 \times 1} = 0.032$ inch in the case of turning.

In the case of external grinding with a wheel of 8 inches in diameter, the permissible error H of height setting is given by:

$$H \leq D\sqrt{e/d} \leq 8\sqrt{1/1000 \times 1} \leq 0.26 \text{ inch}$$

When grinding a similar internal taper with a grinding wheel of 1/2-inch diameter, the D/d ratio is 0.5 and the permissible error in setting H is given by:

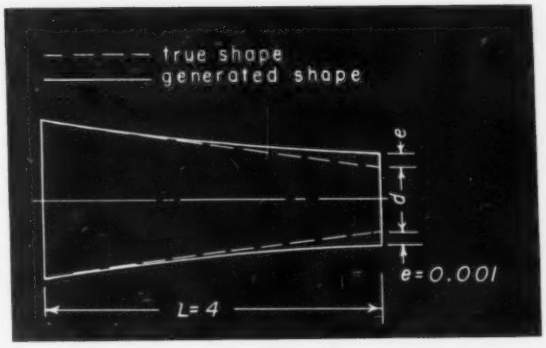

Fig. 4. When turning a taper 4 inches long having a 0.0005 inch-per-inch tolerance on the diameter (e = 0.001), the maximum permissible error (h) in setting the tool is 0.032 inch.

$$H \leq (1 - D/d)\sqrt{ed} = 0.5\sqrt{1/1000 \times 1} = 0.013 \text{ inch.}$$

The corresponding permissible wheel-spindle setting errors in grinding a taper gage with a tolerance as low as $\pm$ 0.00005 inch on the taper are:

$H \leq 0.09$ inch for external grinding with a wheel 8 inches in diameter,

$H \leq 0.004$ inch for internal grinding with a diameter ratio of $D/d = 0.5$, and

$H \leq 0.0016$ inch in internal grinding with a diameter ratio of 0.8.

These values illustrate the care with which grinding spindles have to be set for the manufacture of parts having precision tapers, especially those requiring internal ones.

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More Aluminum in Automobiles

The automotive industry in this country may use as much as 337 million pounds of aluminum in 1959—almost 48 per cent more than the estimated consumption of metal last year. A survey conducted by Kaiser Aluminum shows that the new cars contain an average of 57.1 pounds of aluminum. That compares with a 50-pound average in the 1958 models, and 46.3 pounds in the 1957 models. The Chrysler Imperial will carry 131.5 pounds of aluminum—the most in any car.

Aluminum alloys are replacing stainless steel as decorative trim for grilles, fenders, seats, and window moldings. Ford is switching to die-cast aluminum transmissions for its 1959 cars; and more Chevrolet buyers prefer the optional Turbo-Glide transmission, made almost entirely of aluminum.

Detroit's aluminum needs in 1959 would amount to only 7 per cent of the year's projected output of new aluminum in this country.

FLUING HEAVY METAL SECTIONS

R. A. BUTLER, Plant Engineer
Struthers Wells Corporation
Titusville, Pa.

"FLUING," or "pulling flues," is a press technique used by plate fabricators, such as manufacturers of boilers, processing equipment, and weldments. Its purpose is to turn out or flange and enlarge openings in ferrous or non-ferrous plate—like pressure-vessel heads, shells or flat plates for manways, handholes, expansion-dome connections, and other types of inlets or outlets—by stretching the circumference of a hole.

A feature of flued openings is that they are an integral part of a product and tend to streamline, strengthen, and increase the rigidity of a section—often without recourse to reinforcement pads or banding, as is usually necessary with a fitted and welded sub-assembly connection.

In a recent project, the Struthers Wells Corporation, Titusville, Pa., had the interesting experience of developing, designing, and putting to use dies to flue 54-inch dome openings in precurved sections of 1 1/4-inch thick aluminum plate. These plates, for pressure-vessel courses, had an inside radius of 43 1/2 inches. The operation was performed on an 800-ton hydraulic press, having a 12 1/2-foot daylight opening and a 6- by 12 1/2-foot column spacing.

The nature and magnitude of this project might have required a considerable amount of experimental work and a substantial investment in full-size dies and in material for the die tryouts. To economize, one-tenth scale models of the dies and work (shown in the accompanying illustrations) were prepared. The fluing of the models was done on a 50-ton hydraulic press.

A few tryouts indicated the optimum temperature of the work for fluing, the proper size of the initial hole that had to be flame-cut in the material prior to fluing, and also certain critical die dimensions to prevent scoring, tearing, or wrinkling. The models also showed the maximum height of flue to which the material could be pulled safely.

Because the section to be flued was curved, the flame-cut hole had to be oval. The appearance of the hole before and after fluing can be seen in Fig. 1. Computations to determine the dimensions of the oval appear in Fig. 2. The required finished height of the flue—6 1/4 inches at the narrowest point on the longitudinal axis of the shell—meant that the pulled height had to be 6 3/4 inches, allowing 1/2 inch for subsequent trimming.

Thinning out of the material at the end of

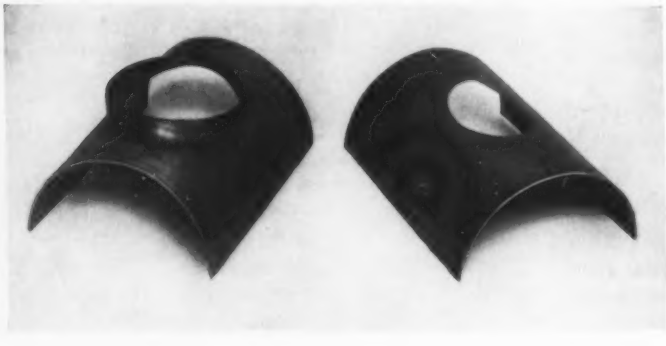


Fig. 1. The oval hole flame-cut in the shell (right) becomes a round flue (left) in the forming.

the flue posed a problem, since the cross-section there had to be the same as the peripheral area of the oval. To control the thinning so that the cross-section would at least equal the thickness of the adjoining dome assembly became a simple matter of finding the proper size of the oval.

Fluing subjects the material to considerable deformation, since it is stretched, bent, flanged, and drawn simultaneously in different directions. To prevent tearing, scratching, wrinkling, or other distortion, the relatively severe compound change in shape and section must be performed above the recrystallization temperature of the material. For aluminum, formability is greatest at about 750 degrees F.

After the size and other physical aspects of the dies had been determined, the manner of setting them up in the press and operating them was obtained with the help of scaled layouts. From these studies it was possible to devise a safe and efficient means for handling the hot aluminum-plate sections.

Essentially, the fluing required the pre-curved section to be clamped between an upper and a lower die while a plunger was pushed or pulled through the opening in the work. These various elements are shown separately in Fig. 3, and interrelated in the heading illustration.

A drawing of the full-size dies appears in Fig. 4. The end of the plunger could not exceed the smallest dimensions of the oval, which were 28 15/16 by 46 1/8 inches. Also, the largest diameter of the plunger had to control the finished inside diameter of the flue within a tolerance of 1 per cent. Connecting these two known sizes, the tapered portion of the plunger had to be long enough to push the material gently and gradually up and outward around the hole. The resultant taper was a compromise between the tonnage required to push the plunger through the opening and the maximum press stroke available.

To construct the plunger, it was, of course, necessary to establish its major diameter at room temperature. This meant taking into account the expanded size of the oval because of the elevated temperature at which the fluing was performed. Experience showed that the aluminum reached a temperature of about 600 degrees F.—there was a 150-degree F. loss from the theoretical optimum forming temperature (750 degrees F.) by the time the section was positioned in the press. Another complication that also had to be accounted for was the expansion of the steel plunger and clamping dies, since they absorbed heat from the hot aluminum and reached a temperature of about 250 degrees F.

Using coefficients of expansion of the aluminum and steel of 14.8×10^{-6} and 5.56×10^{-6}, respectively, this procedure was followed:

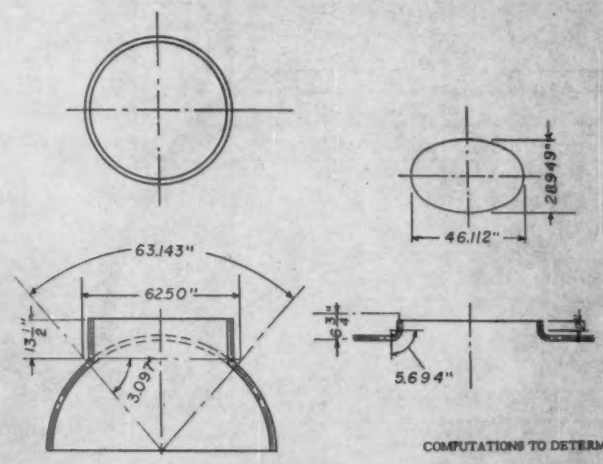


Fig. 2. These computations establish the two axes of the oval hole. An extra 1/2 inch of metal is added to the flue height for subsequent trimming.

COMPUTATIONS TO DETERMINE SIZE OF OVAL HOLE FOR FLUE TO FINISH 6-1/4" HIGH AT MOST NARROW SECTION ON LONGITUDINAL AXIS OF SHELL

(1) 62.50 - [2 (5.694) + 2 (3)] = 47.112" = MAJOR AXIS OF HOLE

(2) 63.43 - [2 (3.097) + 2 (13.5)] = 29.949" = MINOR AXIS OF HOLE

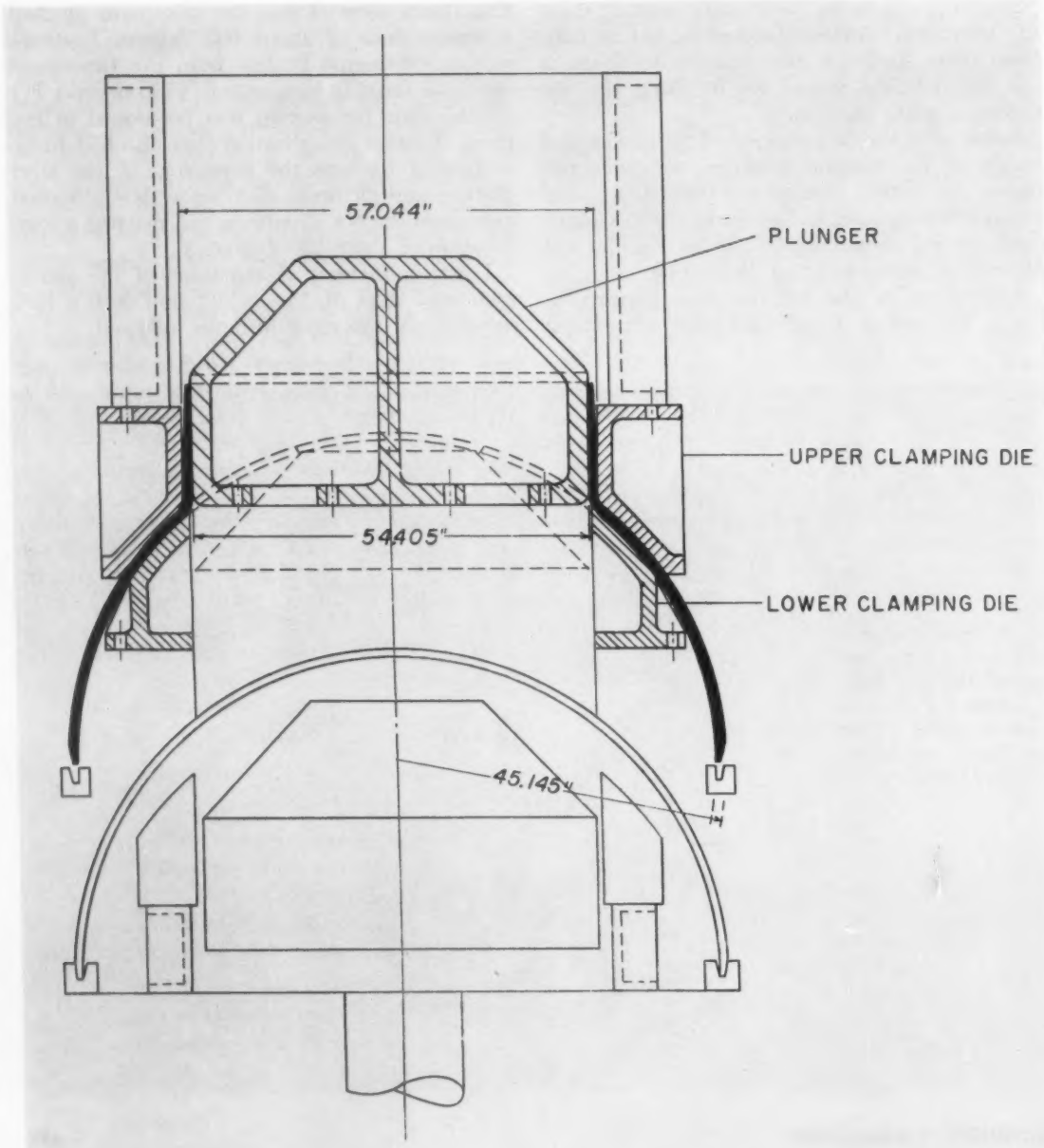
REQUIRE 1/2" STOCK -- THEREFORE:

47.112 - 2 (1/2) = 46.112" FOR MAJOR AXIS

29.949 - 2 (1/2) = 28.949" FOR MINOR AXIS

Fig. 3. (Left) From left to right are the plunger, lower clamping die, pre-curved section, and upper clamping die. Heading illustration shows relationship of these elements after a flue has been pulled.

Fig. 4. (Below) When the plunger moves up, the pre-curved section is clamped between the upper and lower dies.



1. From the inside diameter of the finished flue at room temperature	54.000
2. Obtain the size of this diameter at forming temperature $54 + [(14.8 \times 10^{-6})\ (54)\ (600)]$	54.480
3. Allow for plunger expansion $(5.56 \times 10^{-6})\ (54)\ (250)$	0.075
4. Obtain major diameter of plunger at room temperature	54.405 inches

In much the same manner, it was possible to compute the critical inside diameter of the steel clamping dies at room temperature:

1. To the inside diameter of the finished flue at forming temperature	54.480
2. Add twice the aluminum-plate thickness plus the manufacturer's upper limit on the thickness $2\ (1\ 1/4 + 0.060)$	2.620
3. Add also the increased plate thickness at forming temperature $(14.8 \times 10^{-6})\ (2.620)\ (600)$	0.023
4. Obtain the inside diameter of the dies at forming temperature	57.123
5. Allow for die expansion $(5.56 \times 10^{-6})\ (57)\ (250)$	0.079
6. Obtain inside diameter of dies at room temperature	57.044 inches

The radius of the saddle-shaped clamping portion of the dies was determined in the following manner:

1. To the inside radius of the shell at room temperature	43.500
2. Add the aluminum thickness plus the manufacturer's upper limit on the thickness	1.310
3. Allow for shell expansion at forming temperature $(14.8 \times 10^{-6})\ (43.5)\ (600)$	0.386
4. Allow also for increased shell thickness at forming temperature $(14.8 \times 10^{-6})\ (1.25)\ (600)$	0.011
	45.207
5. Subtract allowance for die expansion $(5.56 \times 10^{-6})\ (44.75)\ (250)$	0.062
6. Obtain radius of clamping portion at room temperature	45.145 inches

All die surfaces which would contact the material were ground smooth. To forestall tearing or splitting, the metal around the starting hole was given a generous radius. Mutton tallow was used as a die lubricant.

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DoALL Expands Metrology Laboratory

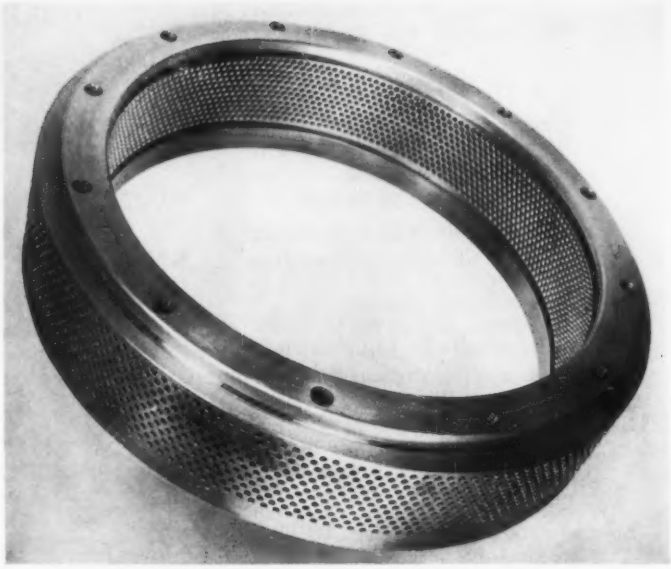
Gage-blocks—including their "AAA" grade blocks and "A" grade Shop-Blocks—are now being mass-produced in a remodeled and expanded metrology department at the DoALL Co., Des Plaines, Ill. The "controlled-environment" area for finishing and calibration has been enlarged by one-third and equipped with an electronic-precipitator air-conditioning system that removes up to 90 per cent of all foreign matter, including dust, pollen, and smoke. Also, a Link Fringecount micrometer has been added to the line-up of precision metrology equipment.

Manufacture of gage-blocks starts in the plant along with other precision work. They are machined, carefully heat-treated, and then stabilized. A special stabilizing process is used that requires a lower temperature than it is possible to obtain with standard equipment. Therefore, DoALL has built its own three-stage unit which provides a minimum temperature of 180 degrees below zero F., and sufficiently rapid heat transfer to completely stabilize the blocks. After stabilizing, the blocks are accurately ground to within a few thousandths inch of the finished size. At this point they enter the controlled-environment area for finishing.

As all standard measurements are expressed at 68 degrees F., temperature must be meticulously controlled to assure uniform accuracy in millionths. Complicating this is the fact that humidity must be held below 40 per cent. To achieve these conditions, the filtered air is cooled to 42 degrees F., at which temperature the excess moisture is effectively squeezed out. The cold air is then reheated to the desired 68 degrees F., thus providing the necessary humidity control while permitting the exact temperature to be maintained by regulation of the added heat.

Due to the accuracy to which gage-blocks are calibrated, additional measures are taken to remove, or compensate for, all known variables. Because the new Fringecount micrometer and a Zeiss Optom interferometer—as well as other instruments used in calibration of master gage-blocks—depend upon light waves for their accuracy, and because light waves are affected by barometric pressure, this too is kept under surveillance. Furthermore, sensitive instruments are mounted on special vibration-proof foundations.

Gun-Drilling Setup Slashes Die-Making Time



HUNDREDS of close center-distance holes in tool-steel rings are now produced on a multiple-station, dial type machine tooled with carbide-tipped gun drills. These rings, one of which appears in Fig. 1, are actually extrusion dies used in pellet mills.

The dies are made in various sizes, with the holes ranging in diameter from 3/32 to 3/4 inch and from five to fifteen diameters in length. They must be spaced uniformly, and in addition, they must have a good surface finish. With the present machining setup, piece time averages six hours, in marked contrast to the original time of ninety hours when holes were produced individually on conventional upright drilling presses.

Sprout, Waldron & Co., Muncy, Pa., which makes the dies, developed the new machine in collaboration with the Eldorado Tool & Mfg. Corporation, Milford, Conn., supplier of the gun drills. The machine, Fig. 2, consists of six self-contained units spaced equally around a circular table. The gun drills—one in each unit—operate simultaneously, thus producing six holes in each cycle. Between cycles, the table indexes radially an amount corresponding to the hole center distance. Then, when all the holes in a circumferential row in the die have been completed, the table indexes axially, and another row is started. Electrical counters control the operation.

Drills are piloted in bushings. The coolant, a sulphurized cutting oil, is delivered under high pressure through the bodies of the drills, which are tubular. Chips are removed and the coolant filtered and recirculated by a Delpark system.

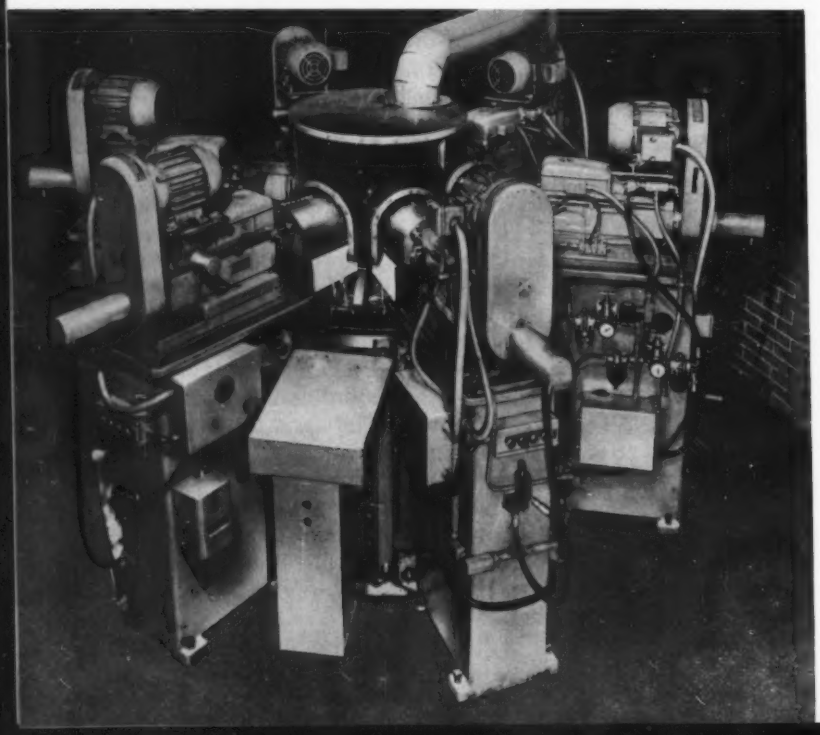
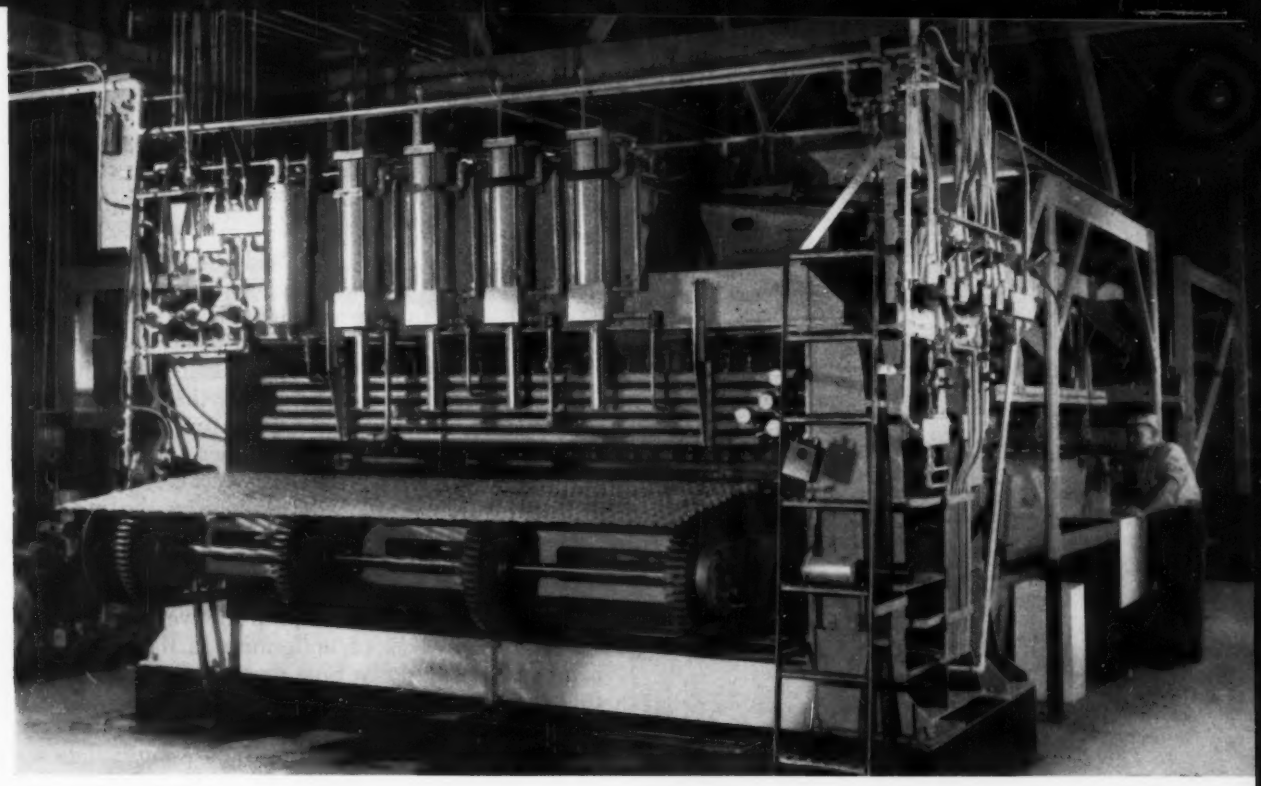


Fig. 1. (Above) The holes in this extrusion die are produced in groups of sixes by the gun drills in the self-contained units.

Fig. 2. (Left) The die is mounted on a circular indexing table in the center of the six self-contained units.



Honeycomb Grating Formed and Welded Automatically

AN INGENIOUS MACHINE automatically converts rectangular bars of steel to honeycomb grating at a rate of 5000 square feet per eight-hour day at Bustin Steel Products, Inc., Dover, N. J. According to Leo Bustin, company president and designer of the machine, product quality has improved under automatic manufacture, and in addition, the customer will benefit from the reduced cost.

The machine, 40 feet long, 22 feet wide, and 11 feet high, develops a wavy pattern in each bar in two forming stages, then welds one bar to the preceding one to create the honeycomb. With former manual methods, the services of twenty-four men were required to turn out the

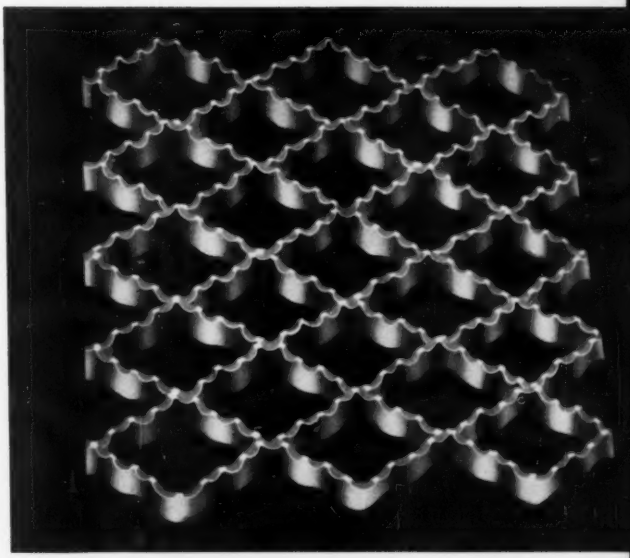


Fig. 1. The notched upper edges and honeycomb design in combination create an all-directional, nonslip safety grating having a comfortable surface.

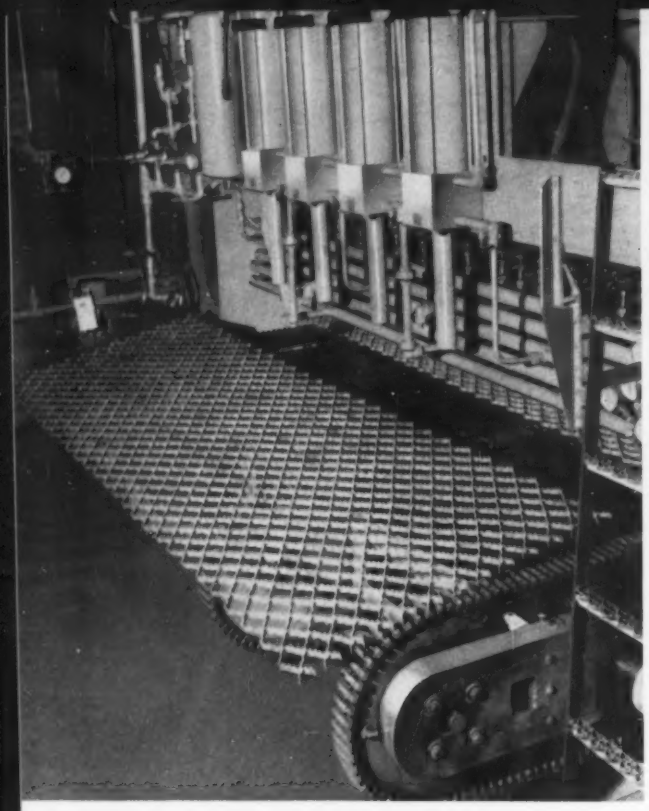


Fig. 2. A predetermined width of the formed and welded grating leaves the machine. Final steps consist of painting or galvanizing and baking.

same amount of grating. This manpower can now be absorbed in other tasks about the plant.

A close-up view of the honeycomb pattern appears in Fig. 1. Unlike most gratings, no side (straight) bars are needed between alternate rows of the wavy bars. In Fig. 2 is shown a section of grating coming off the exit end of the machine. Another section can be seen farther back on the conveying belts, emerging from position beneath the welding guns.

Seven years were required to bring the machine to its present state of operation. Initially, a one-third-size model was made for developing the progressive feeding and indexing mechanisms. Except for the welding, the model performed every motion of the full-scale machine.

One of the developmental problems from the start concerned the specification of the steel bar. Working with engineers of the Sharon Steel Corporation, a special hot-rolled bar was developed with the necessary properties. Because of the delicate nature of the adjustments on the machine, the steel has to have an absolutely uniform molecular content. This is particularly vital in the first forming (preforming) stage, where metal fatigue must be avoided, and in the welding operation, where lack of uniformity in the metal can cause costly down time or necessitate resetting the controls.

The bars used measure from 1/2 by 1/8 inch to 1 by 1/8 inch, according to the grating being made, and come in lengths up to 10 1/2 feet. In preparatory operations, scale and rust are removed by shot-blasting in a Pangborn cabinet. The stock is then automatically index-fed through a press where a gang of punches quickly notches one edge to create the non-slip design.

Now ready for the grating machine, the bars are stacked on a 40-degree loading chute, seen on the right in Fig. 3. The bars drop into a "peeler" which pushes them one by one onto receptacles on conveyor belts. They are then carried to a predetermined position where they are picked up in pairs by a double row of mechanical fingers running the width of the machine. These fingers are suspended from an overhead air-oper-

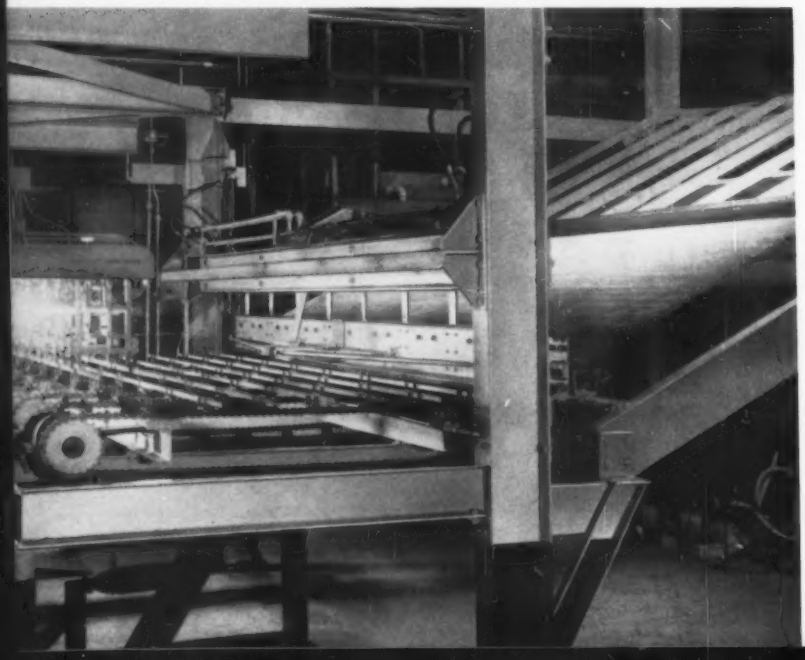


Fig. 3. At the head of the machine, the bars are taken by conveyor belts to dual sets of multiple fingers suspended from a walking beam.

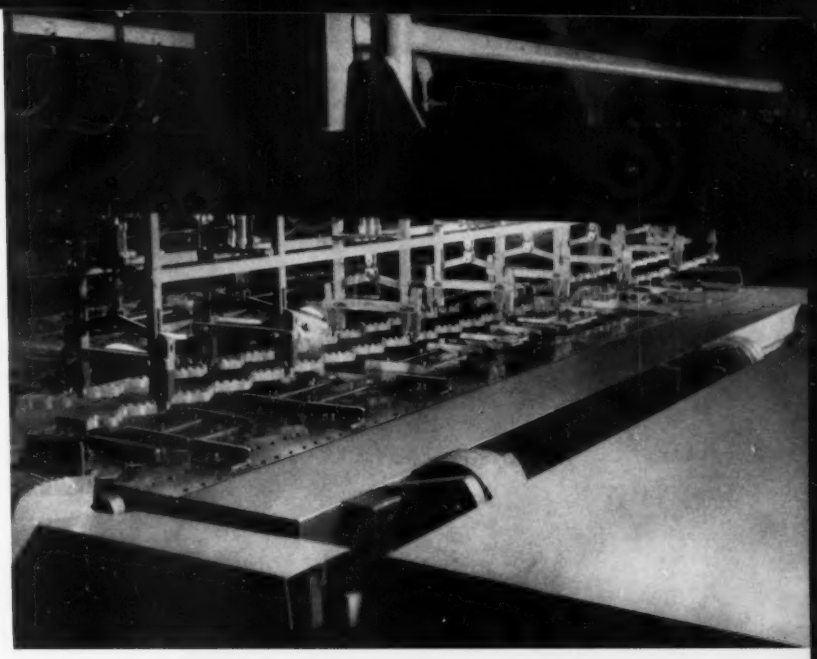


Fig. 4. Two sets of preforming dies and two sets of forming dies produce the wavy pattern. Steel fingers in foreground are extracting bars from preforming dies.

ated walking beam which shuttles back and forth, advancing the bars in turn to the preforming, forming, and welding stations.

At both the preforming and forming stations, multiple die-block sets converge laterally to produce the wavy pattern in two bars at a time, as illustrated in Fig. 4. To assure correct location of the bars, permanent magnets have been incorporated in several of the die-blocks. The die-block sets are readily interchangeable, so that different grating designs can be produced.

From the final forming, other mechanical fingers lift the bars and convey them to an indexing table for the welding operation. The welder, seen in Fig. 5, is a 14-ton, multiple-spindle unit, operating on 700 kva. (Transformers are located outside the plant.)

Index forks shift each alternate bar as it approaches the welder to align its wave crests with those of the preceding bar. When the wave crests of both bars are in contact, the electrodes of each resistance-welding gun descend over the full height of the metal. Pressure and current are then applied.

As quickly as a bar is welded to the preceding one, another bar is fed to the welder. The process is continuous. Theoretically, grating of infinite width could be produced. Actually, a timing device interrupts the flow of current through the guns to produce required widths from 6 to 48 inches.

Upon leaving the machine, the grating passes to a paint dip and then to an oven, where it is baked at 350 degrees F. for three minutes. It is then conveyed on a belt to the shipping department. Within the next few months, complete automation of the entire manufacturing process—from the preparatory operations of shot-blasting and notching through the finishing operations of dipping and baking—is planned.

Bustin's "Firm-Grip" grating has broad industrial application for stair treads, platforms, and catwalks. It is virtually impossible to slip on this grating, even when it is coated with heavy grease. A stainless-steel type of the grating is made for the chemical and food-processing industries.

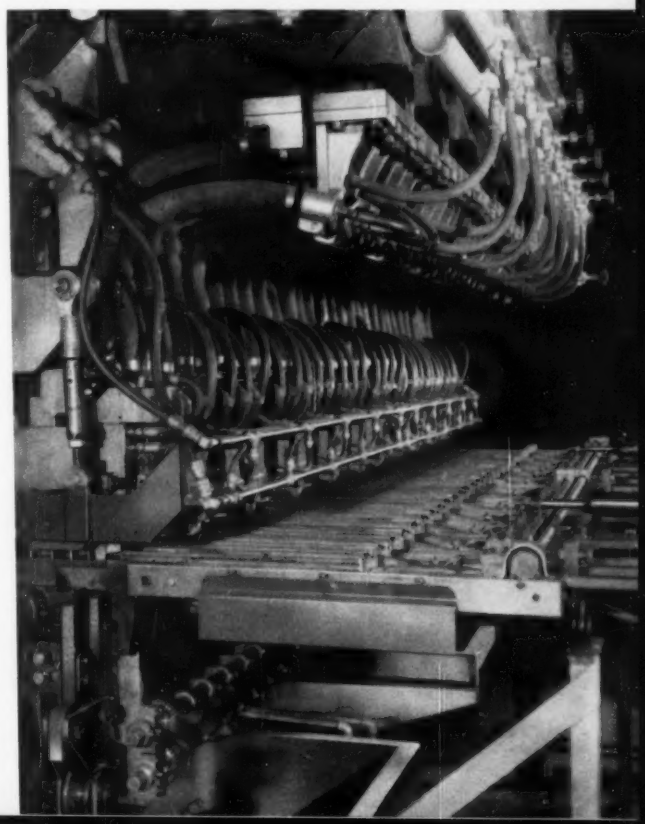


Fig. 5. When the wave crests of adjacent bars are aligned and in contact, the electrodes descend and pinch the joints, welding the full height of the metal.

Progress Report on Ultrasonic Welding

ULTRASONIC WELDING, unknown ten years ago, is today an accepted technique for joining many light-gage similar or dissimilar metals. Originated and developed by Aeroprojects Incorporated, West Chester, Pa., the technique introduces vibratory energy into the metals in the weld area, joining them in approximately one second or less. The resulting union is characterized by the lack of a fusion zone, low external deformation, and high strength. No electric current flows through the joints, so there is no arc, spark, or sputter to contaminate the surrounding area.

Thin metal foil can be welded to other thin metal foil, or to heavy materials. Ultrasonic welding has a relatively low power requirement, often as low as 5 per cent of that required in resistance welding. Among other advantages: Surface preparation is usually limited to degreasing; special controlled atmospheres are rarely required; clamping forces are low; and many anodized or insulated materials can be welded without removal of the insulating or protective coating.

Exotic metals such as molybdenum, niobium, tantalum, zirconium, titanium, Inconel, Inconel X, and 17-7 PH stainless steel can be welded in sheet gages up to about 0.030 inch. The process produces a high degree of internal deformation of the faying surfaces without any particular external deformation.

Basic equipment includes a transducer-coupling system for generating vibratory energy and delivering it to the welding area, a means of supporting the work and applying clamping force

Fig. 1. Small work is centered under the welding tip by coordinate movement of the welding fixture. A microscope mounted on a movable base is employed to observe the operation.

Fig. 2. For use on a production line, the portable spot type welding head is suspended from an overhead cable. The generator, mounted on casters, is moved to point of operation.

to the welding area, and an electronic generator to supply high-frequency alternating current to the transducer. The transducer, a laminated stack of thin nickel plates, undergoes a microscopic change in dimension in the magnetic field of the generator. As the intensity of this magnetic field changes thousands of times per second, the stack continuously changes its length, converting the high-frequency alternating current to vibratory energy. This vibration is transmitted in shear to the upper welding tip ("sonotrode").

Aeroprojects' equipment-making subsidiary, the Sonobond Corporation, has developed ultrasonic welders for a variety of industries. A 100-watt instrument, Fig. 1, is used in laboratories and in the electronic industries to join extremely small diameter wire or thin foil. Typical application is a bridgewire configuration, in which a 0.0015-inch platinum-tungsten resistance wire is welded ultrasonically to two 0.025-inch copper terminal posts. At the other end of the equipment range is a new 4000-watt unit capable of welding 2024-T3 Alclad aluminum 0.090 inch thick.

A 2000-watt unit, Fig. 2, has a portable head which can be used up to 150 feet from its generator. An industrial application is the welding of aluminum cab and car bodies. For welding a continuous seam, as in the heading illustration, the work is processed in equipment having two rollers. The upper one delivers the ultrasonic energy, while the lower one supports the work. Continuous-seam welders are used for encapsulating materials such as drugs and chemicals, and for aluminum-foil packaging.

In addition to this "Sonoweld" equipment, a line of "Sonosolder" and "Sonobraze" machines is also produced. In the latter, the vibratory energy produces cavitation in the molten solder or brazing material, tearing off the oxide film that normally prevents effective bonding. Thus, no flux is necessary. The solder itself is melted by some type of heating device. In Fig. 3, a silicon disc is being soldered ultrasonically. The work is supported on an electrically heated platen. Within the soldering head is a transducer which is coupled to the tip.

Fig. 3. The soldering tip sets up vibratory energy which produces cavitation in the molten solder, eliminating the need for a flux. Solder becomes molten from heat of platen.

MATERIALS

The properties and new applications of materials used in the mechanical industries

Air-Hardening Die Steel Which is Free Machining

A 5 per cent chromium, air-hardening die steel with uniformly distributed sulphide particles which impart free-machining characteristics has been announced by Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa. Called "Sagamore-EZ," it is tougher than most free-machining die steels and in wear resistance is intermediate between the manganese oil-hardening and the high-carbon, high-chromium types.

The steel's nominal percentage composition is carbon, 1.00; chromium, 5.00; vanadium, 0.20; molybdenum, 1.00; and sulphur, 0.12. It is suited for a wide range of applications in which toughness is combined with wear resistance. Typical uses are: dies, rolls, and blanking and forming punches; trimmer dies, cold or hot; plastic-molding dies; straightening and bending dies; and gages.

Process for Plating Chromium Directly Over Aluminum

The development of the "Chrom-Lume" process for plating chromium directly to aluminum and its alloys has been made available by Service Hard-Chromium Co., Route 22, Union, N. J.

This process eliminates the need for the deposition of intermediary metals such as copper and nickel and provides a surface which is hard, oxidation resistant, and withstands chipping, peeling, cracking, and flaking. The plating, which has a sapphire-gray color, can be buffed to a bright luster. Uses include the plating of fasteners, gears, pumps, valves, flow-control devices, and pulleys.

Magnesium Alloy that Requires No Stress Relief after Welding

A magnesium sheet and plate alloy that does not require stress relief after welding has been developed by the Dow Chemical Co., Midland, Mich.

The alloy, called "ZE10A," containing zinc and rare earth metals as alloying constituents, has good toughness. Its typical mechanical properties in the H24 temper (strain hardened, then partially annealed) include: ultimate tensile strength, 38,000 psi; tensile yield strength, 28,000 psi; compressive yield strength, 26,000 psi. The alloy also is furnished in the -O temper (fully annealed).

The company lists missile shipping and storage containers, shipping containers for commercial bulk products, and tank-trailer bodies as possible applications.

Aluminum Bronze that Combats Stress-Corrosion Cracking

The use of "Ampco Grade 8 Alloy" to combat stress-corrosion cracking has been made available by Ampco Metal, Inc., 1745 S. 38th St., Milwaukee, Wis. The use of this alloy has made it possible to eliminate the usual stress relieving during fabrication to guard against stress-corrosion cracking. Furthermore, alterations and repairs can now be made without heat-treatment. Applications for this alloy include paper-mill drier rolls, brewery percolators, heat exchangers and sea-water evaporators, distillation equipment, and high-pressure piping.

Tungsten-Carbide Powders for Hard-Surfacing and Abrasives

A complete line of sintered tungsten-carbide powders for hard-surfacing, abrasives, diamond settings, plastic dies and other applications where a hard, wear-resistant material is required has been announced by the Shwayder Chemical Metallurgy Corporation, 684 E. Woodbridge, Detroit 26, Mich. "Mikrocarbide," as these powders are called, consists primarily of sintered tungsten carbide with small amounts of titanium and tantalum carbides in a cobalt binder. Hardness of the individual particles averages 91.5 Rockwell A.

The powders are available in hard-surfacing welding rods. Coarser grades of Mikrocarbide in the proper matrix, can be used on cutting tools for stone, earth, concrete, and masonry. When added to an epoxy resin, they facilitate the making of inexpensive plastic dies. As abrasives they can be used in permanent sanding blocks, abrasive

wheels, polishing powders and pastes, and as secondary abrasives in metal-bonded diamond wheels and dressers.

Bright Cold-Drawn Steel Bars Now Standardized

The Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pa., is now offering cold-drawn steel bars that are bright. This product, called "Bright-Drawn," has been made available as its standard cold-drawn bar and is used for the machining of precision parts. The bars are supplied in rounds from 1/16 to 4 inches in diameter, hexagon shapes from 1/8 to 3 1/16 inches, squares from 1/8 to 4 inches, and flats up to 6 inches wide.

Iron-Powder Electrode for Welding Manganese Steels

The Lincoln Electric Co., Cleveland 17, Ohio, has announced the availability of an electrode to facilitate welding of 12 to 14 per cent manganese steels. The electrode is suitable for building up manganese steel hard-surfacing deposits on either manganese or carbon steels and also for making sound joints between two manganese steel parts or between manganese and carbon-steel parts.

"Mangjet," as it is called, is a low-hydrogen, iron-powder electrode that has a high deposit rate, and gives smooth beads and a steady arc. It is used with both AC and DC welding machines. Available in 5/32-, 3/16-, and 1/4-inch sizes, these electrodes deposit about twice as much weld metal per electrode as conventional, non-iron powder electrodes. Deposits have a wear resistance comparable to heat-treated, cast manganese steel. In joints, these deposits are comparable to those made with stainless-steel electrodes and can be torch cut on repetitive jobs, such as replacing dipper teeth.

High-Strength Columbium-Treated Steels for Steel Fabricators

A line of columbium-treated, high-strength mild carbon steels has been offered by Great Lakes Steel Corporation, Ecorse, Mich. Known as the "GLX-W series," these steels are identified by means of their yield strengths. To illustrate, GLX-45-W indicates a mild carbon steel with a minimum yield strength of 45,000 psi; GLX-50-W, a steel with a minimum yield strength of 50,000 psi; GLX-55-W, one with a minimum yield strength of 55,000 psi; and finally, GLX-60-W, one with a minimum yield strength of 60,000 psi.

This series of steels has typical ultimate tensile strengths ranging from 70,000 to 82,000 psi and elongations in 2 inches ranging from 43 to 34 per cent. They are readily weldable and formable. Uses include fabrication of truck trailers, loading devices, railroad cars, steel flooring, pipeline, and formed sheets.

Cutting Fluid for Use with Throw-Away Carbide Inserts

A water-soluble cutting fluid developed by the Shell Oil Co., 50 W. 50th St., New York 20, N. Y., was designed primarily for high-speed production equipment use in the aircraft, missile, automotive, and heavy machine industries.

Called "Dromus Oil E," it is diluted in the ratio of one part oil to twenty parts water. This mixture acts as a good coolant and at the same time

The use of a dilute solution of Dromus Oil E resulted in a one-third increase in feed rate in this machining operation employing throw-away carbide inserts.

protects carbide tools against breakage resulting from thermal shock. Use of the fluid facilitates keeping of close dimensional tolerances by reason of reduced work-piece heating and results in the production of cool chips and a bright, rust-resistant finish.

High-Strength Aluminum Alloy that Provides Good Castability

An aluminum alloy, designated "Alloy 357," of high tensile and yield strengths with high elongations and good castability has been announced by Reynolds Metals Co., Richmond 18, Va. In the permanent-mold T-6 form it has a tensile strength of 48,000 to 50,000 psi, a yield strength of 35,000 to 37,000 psi, and an elongation of 6 to 10 per cent.

High-Strength, High-Speed Tungsten Carbide for High Temperatures

An ultra-hard, steel-cutting tungsten-carbide grade is being offered in Indexable blanks by the Carmet Division, Allegheny Ludlum Steel Corporation, Ferndale, Mich. "CA-604," as this material is called, facilitates high-velocity finishing with light to medium feeds. One of its major features is its high strength at high cutting temperatures. This material has exhibited long wear life on such operations as precision boring and turning where size tolerances and surface finishes must be held. It is highly crater resistant.

Air-Hardenable, High-Strength Alloy Sheet Steel for Missiles and Rockets

The development and production of an air-hardenable, high-strength alloy sheet steel for missiles and rockets has been announced by the United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. When cooled in air and tempered, this steel, called "Airsteel," develops tensile strengths of about 280,000 psi.

It is supplied in the annealed or soft condition, which allows easy forming, cutting or shaping to the desired form. The material is weldable by the metallic and inert arc-welding methods. Primarily a sheet-steel development, it is also available in billets, blooms, bars, and plates. Uses up to date have included missile and rocket-motor cases.

Aluminum-Bronze Wear-Strip Material for Fabrication and Maintenance

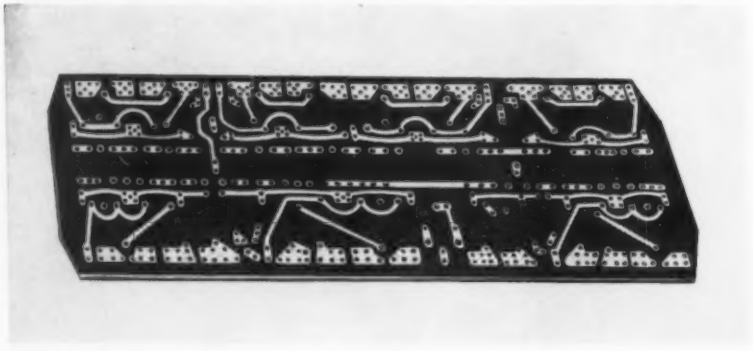
A wear-strip material containing aluminum and bronze, known as "Meier Wearite," has been introduced by the Meier Brass & Aluminum Co., 1471 E. Nine Mile Road, Hazel Park, Mich. Produced in rectangular forms by the extrusion process or in semi-continuous castings, it is available for such applications as wear plates, slides, and gibs for making and maintaining machines.

The material has a smooth surface, fine wear characteristics, and good machinability. It also exhibits resistance to corrosion and has good fatigue characteristics. Both the extrusions and castings are available in two grades containing different proportions of aluminum and copper with a relatively small proportion of iron. Depending on the type chosen, tensile strengths range from 70,000 psi to 105,000 psi with a yield strength of from 40,000 to 65,000 psi and a Brinell hardness range of from 187 to 307.

Stainless-Steel Honeycomb Structure Made Available

A stainless-steel honeycomb structure for use in high-speed aircraft and missiles has been announced by the Crosley Division, Avco Mfg. Corporation, 1329 Arlington St., Cincinnati, Ohio.

Called "Avcomb," the material consists of hexagon steel cells, shaped much like the honeycomb cells made by bees, with a thin sheet of stainless steel brazed on both sides of the honeycomb. It is about 1/2 inch thick, and can be made in various shapes to fit the contours of any surface. Although it has the same strength as a piece of stainless steel of the same thickness, it weighs only about a tenth as much.



This printed circuit is made from "Copper Clad Phenolite Grade G-11-861-1" which is particularly useful for military electronic circuits in rockets, missiles, and computers. It has a bond strength of 10 to 15 pounds, a dip-solder resistance greater than 30 seconds at 500 degrees F., good arc resistance, and is dimensionally stable. The material is a product of National Vulcanized Fibre Co., Box 311, Wilmington, Del.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Bar-Stock Clamp for Lathe Compound

JOSE SOBKOWIAK, Jackson, Mich.

A device for clamping work-pieces made of bar stock to the compound of a lathe for drilling, milling, or facing operations is here illustrated. Easily adjusted to hold round, square, hexagonal-, or octagonal-shaped bars in a wide range of sizes, this versatile arrangement facilitates the machining of both production and short-run work. Clamping is accomplished by the tightening of a single bolt.

The base *A* of the attachment (Figs. 1 and 2) is mounted on the lathe compound *B* and held in place by two cap-screws. These screws are tightened into threaded holes in member *C*, which has been machined to fit the T-slot normally used for the toolpost. Work-holders *D* and *E* are fastened to the base with cap-screws that go through slots in these members. Both work-holders have a V-groove machined at both top and bottom, one having an included angle of 120 degrees, the other, 90 degrees. These two angles will accommodate round or four-, six-, and eight-sided shapes. Member *E* has a series of threaded holes which are used to adjust the height of a clamp *F* to suit the bar stock being machined.

Clamp *F* is made of two pieces cut from flat stock and is held together with two rivets. Two

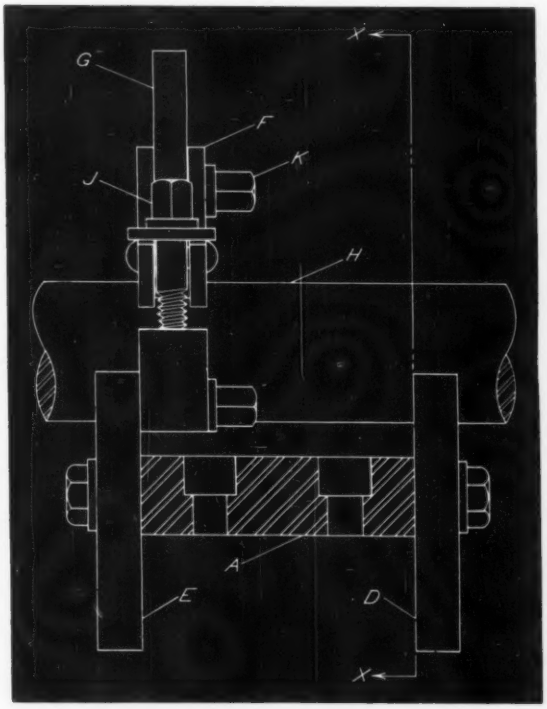


Fig. 1. Clamping arrangement that holds bar stock to a lathe compound for machining purposes.

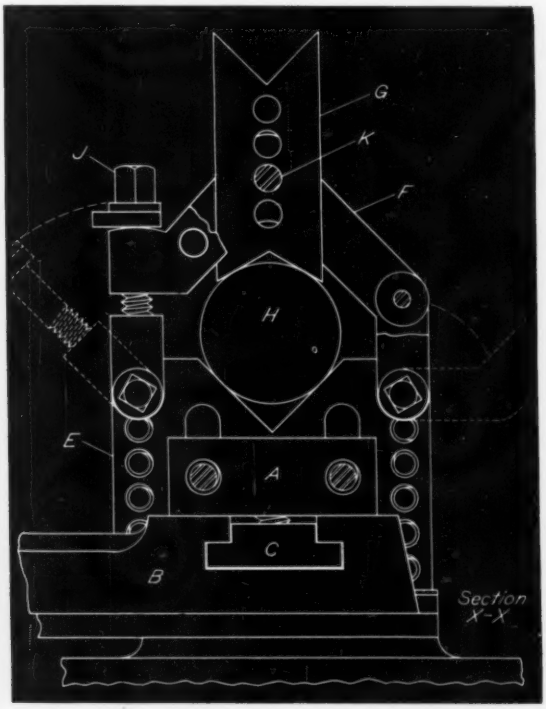
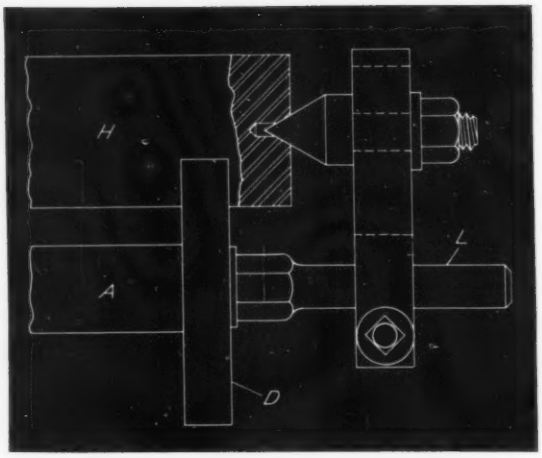


Fig. 2. Screw (J) and clamp (F) both swing clear to allow easy loading and unloading of work.

Fig. 3. Stop for locating work-pieces that permits uniform center-drilling. Center may be replaced by a stud for positioning work-piece from face instead of center hole.



spacers slightly over the thickness of clamp jaw *G* are placed between the pieces at the points where the rivets are applied. The clamp jaw has V-grooves to match those in the work-holders and a series of drilled holes that are used for height adjustment to accommodate a variety of stock sizes. The attachment is opened to receive the work-piece *H* by loosening screw *J*, swinging it outward and raising the clamp. Then, clamp jaw *G* is adjusted in height and screw *K* is tightened in place. The vertical position of the work-piece is adjusted by loosening the cap-screws retaining work-holders *D* and *E* and sliding these members up or down as required. For convenience, square-head screws having the same size as the one for the toolpost are used throughout.

Applications of the device include facing of work-pieces with either a fly cutter or an end-mill mounted in the lathe spindle. Drilling and center drilling are also possible. A number of holes can be accurately spaced in a line by employing the micrometer dial on the lathe cross-slide. In addition, by swinging the compound rest, angular faces can be machined on the work-piece.

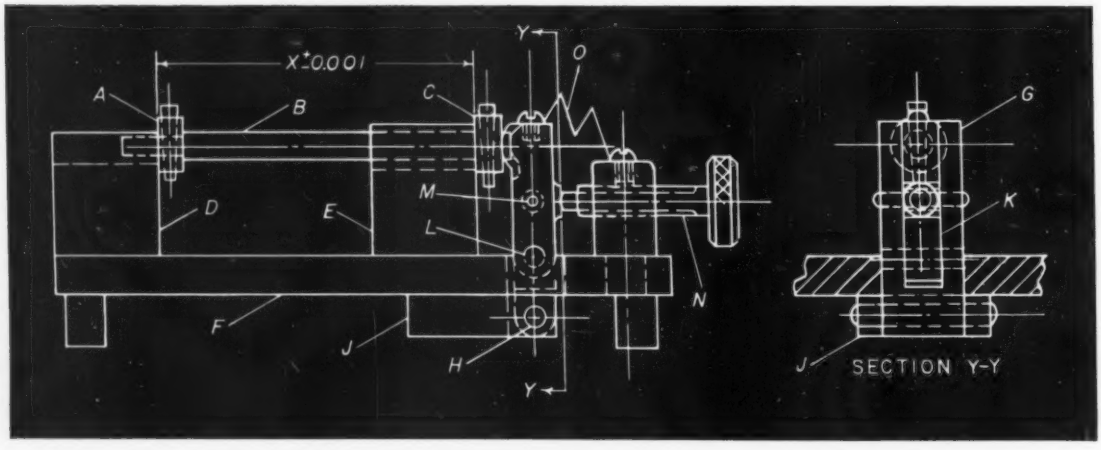
With a fly cutter and a center drill used in combination, work-pieces can be rapidly faced and center-drilled on one end. Then, after resetting the carriage stop, the same operations can be performed on the opposite end, all pieces being uniformly produced. A stop of the type shown in Fig. 3 may be used for positioning work-pieces. Special stud *L* replaces one of the screws holding part *D* to the base. Alignment of the device can be facilitated by first indicating the work-piece in a chuck and then setting up the attachment around the part.

Single Clamp Holds Three-Piece Shaft Assembly

C. Andrews, Dayton, Ohio

A fixture featuring an unusual clamping arrangement designed for holding a three-piece shaft and collar assembly is here illustrated. All three components are securely held against locating surfaces with the turning of a single knob. Although applied to a particular group of parts, the same clamping principle can be used in jigs and fixtures for many similar assemblies.

Collar *A* of the assembly is located against a shoulder on shaft *B* and the distance between the



Fixture that features a single clamp for holding a three-piece shaft assembly.

outside face of collar *A* and the inside face of collar *C* is held to within plus or minus 0.001 inch of a dimension *X*. Basically, the fixture consists of two V-blocks *D* and *E* for holding the shaft, and the clamping arrangement—all mounted on a base *F*.

An outer clamp *G* pivots on a pin *H* which is a press fit in block *J*. The inner clamp *K*, in turn, pivots on pin *L* which is press-fitted into the outer clamp. A pin *M* secured at both ends in clamp *G* passes through a hole in clamp *K*, which is about 1/16 inch larger than the pin. This permits a small rotational movement of clamp *K* relative to clamp *G*. Clamp *K* is held in constant contact with clamping screw *N* by spring *O*.

In using the fixture, the collars are first slipped on the shaft which is then placed in the V-blocks as shown. Turning the clamping screw clockwise moves clamps *G* and *K* forward, but outer clamp *G* strikes collar *C* first to hold it in position against the face of V-block *E*. In the next instant, inner clamp *K* contacts the shaft, the shoulder of which forces collar *A* into position against the face of V-block *D*. The clamps *G* and *K* should be proportioned so that pin *M* is at the center of its clearance hole when all parts are securely held in place for machining. This fixture was used for drilling and reaming the collars and the shaft, in preparation for assembly of the parts with two taper pins.

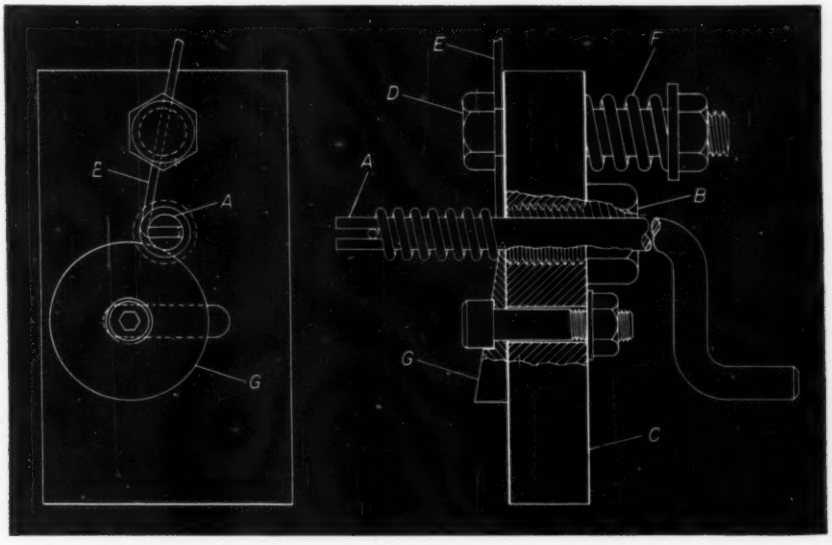
Hand-Operated Spring Winder Simple to Make

ANDREW MIHALKO, Jackson, Mich.

Coil springs can be wound manually at the bench with the easily constructed spring-winding arrangement here illustrated. Within its capacity, this device can be used to accurately produce compression and tension springs for short-run production.

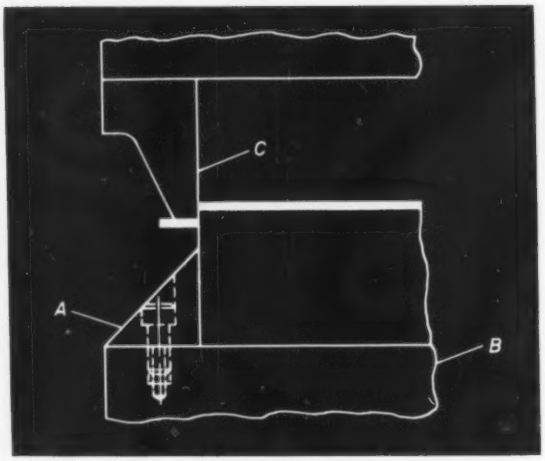
Basically, the spring winder consists of a mandrel *A* mounted in a bushing *B* that is threaded into a support plate *C*. A tensioning screw *D* has a through-hole adjacent to the head to pass the spring wire *E*, and coil compression spring *F* is mounted on the body of this screw for the purpose of applying the necessary pressure. Spring spacer *G* is circular and wedge-shaped, as shown, so that it can be rotated to obtain springs of any pitch within its range. The spring spacer is held in place by a cap-screw which can be positioned anywhere along a slot in the support plate. This arrangement permits the winding of springs of various diameters.

In operation, the wire is inserted through the hole in the tensioning screw and then placed in the slot at the end of the mandrel. The spring spacer *G* is brought up against the mandrel, rotated to the position that will give the desired pitch to the spring, and secured in place with the cap-screw. After adjusting the pressure on the tensioning screw by means of the nut, the mandrel is cranked by hand in the desired direction to wind the spring. For each diameter spring, a different mandrel and bushing are required. The side of the mandrel at which the spring spacer is set is determined by the direction the spring is wound.



Simple in construction, this spring-winding device is manually operated.

SHOP KINKS



Angle-block bolted to die-shoe prevents damage due to accumulation of scrap on die.

Angle-Block Prevents Scrap Pile-Up

ROGER ISETTS, Kenosha, Wis.

In blanking, notching, or other operations where scrap is cut off toward the rear of the die, it is often difficult for the press operator to see these areas. If the scrap should pile up unnoticed and not be removed, serious damage to the die might occur. A simple yet effective method of preventing this hazard is shown in the accompanying illustration. A cold-rolled steel block *A* of square cross-section that has been sawed diagonally across the corners in the manner shown is bolted directly to the die-shoe *B* just below the point on the die where the stock is cut off by the punch *C*. As the scrap falls, it is automatically directed by the block to drop clear of the die.

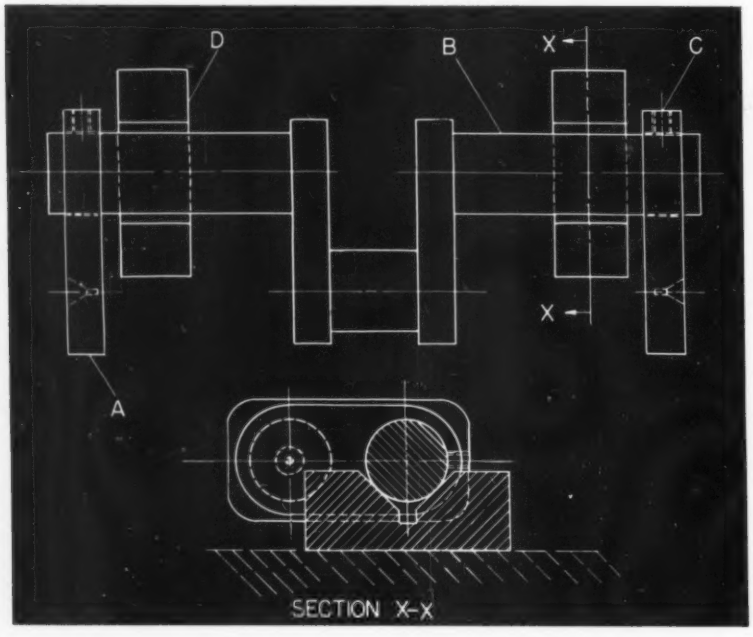
Centering Blocks for Turning Crankshafts

FRANK L. RUSH, Woodbourne, N. Y.

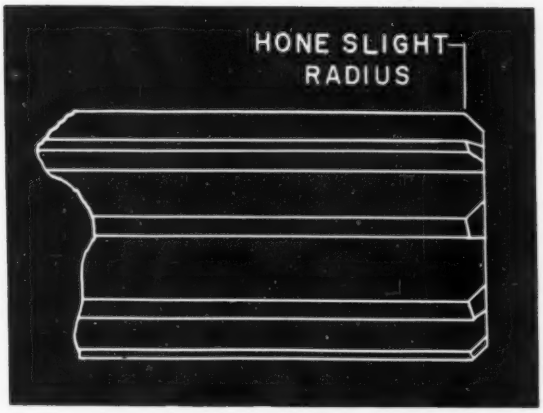
When a solid crankshaft is to be machined on a lathe, some means must be found to support the work-piece while turning the periphery of the crankpin. Centering blocks of the type here illustrated are effective for this purpose.

Machined from steel bar stock, each centering block *A* is bored to a good fit on the crankshaft *B* and center drilled at the required distance from the center of this bore. In addition, the blocks are drilled and tapped to receive set-screws *C*.

In practice, the crankshaft is first center drilled and turned to size on both ends. Then, after supporting the work-piece on a surface plate by V-blocks *D*, the centering blocks are slipped over the ends of the crankshaft, lined up carefully with the crank-arms, and securely locked in position by means of the set-screws. The crankshaft is then placed between the centers of the lathe for turning the crankpin and facing the adjacent surfaces of the crank-arm.



Centering blocks that facilitate turning of crankshafts in a lathe. V-blocks are used to support the work-piece during alignment of the center holes.



Useful life of machine reamers can be extended by honing a radius on each tooth as shown.

Honing Prolongs Reamer Life

HAROLD SEDLIK, Manchester, Conn.

The honing of a slight radius at the intersection of the chamfer and the land of each tooth of new machine reamers prior to their use will result in greater tool life and a smoother finish. In addition, such honing helps the reamer maintain size longer in production.

The radius, as seen in the illustration, should be tangent to both the land of the tooth and the chamfer. Two to five strokes per flute with a fine oilstone will prove sufficient.

Tool for Scribing Pipe Joints

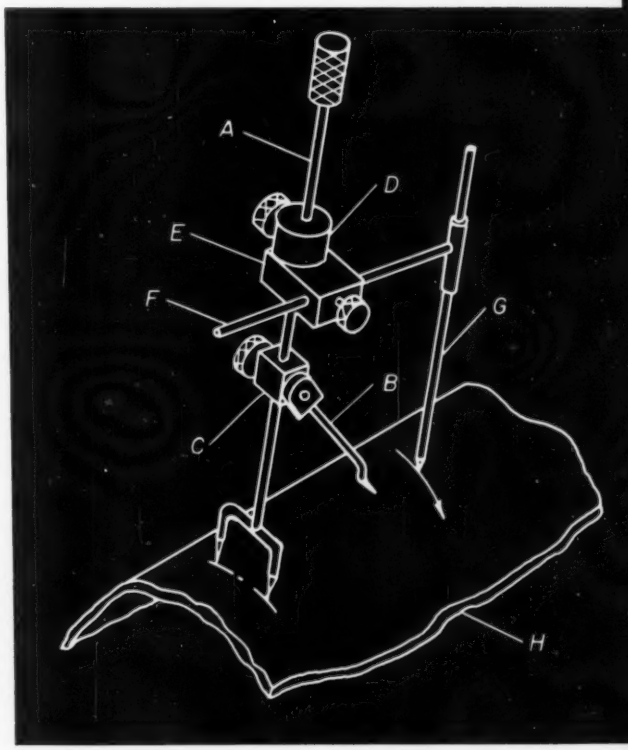
CLINT MCLAUGHLIN, Rockaway Beach, N. Y.

A special tool for laying out the openings required in pipe at the intersection of connecting pipes is here illustrated. Essentially a compass, this device can be used to mark off holes for joining pipe at a wide range of angles.

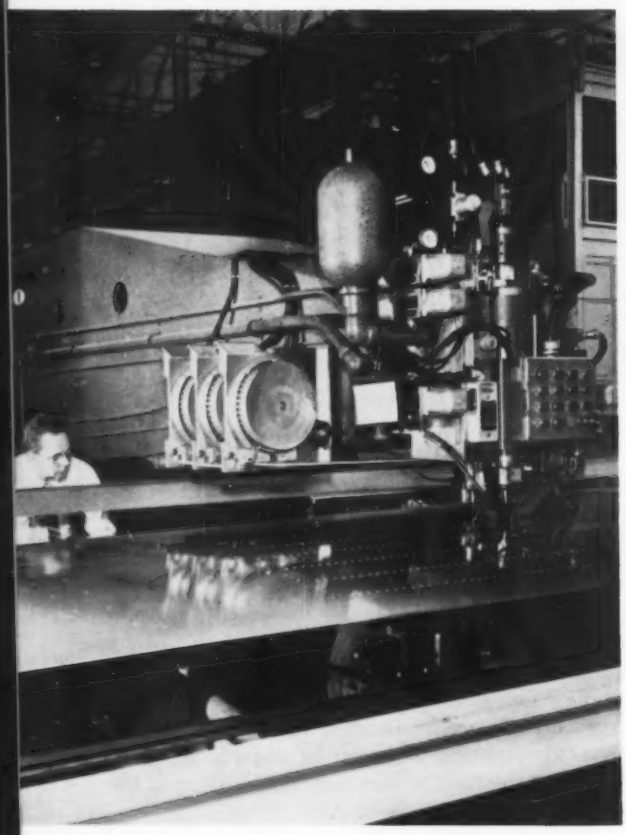
The arrangement incorporates a center rod *A* which has a knurled knob at the top and a double-pointed cross-member brazed to the bottom. When in contact with the pipe, the dual points allow the center rod to be pivoted in only one plane. In use, the rod is stabilized in a fixed position by a side leg *B*. This leg pivots on a block *C* which is made a sliding fit on the center rod. A knurled clamping screw is used to secure the block at any desired point along the rod. The lower portion of leg *B* is offset so that the point will always pivot in a plane common to the center rod.

A collar *D*, located above block *C*, is also made a sliding fit on the center rod. The lower end of this collar is turned to a close tolerance fit in a bore in block *E*. A retaining collar, not seen in the illustration, is secured on collar *D* below block *E*, leaving the block free to rotate. Block *E*, in turn, carries an arm *F* which has a short length of tubing attached perpendicularly to one end. Arm *F* is made a sliding fit in block *E* and is clamped in position by a knurled thumbscrew. A similar clamping screw is used to hold collar *D* in place on the center rod. To complete the device, a scriber *G* is fitted to slide in the tube on arm *F* with a minimum amount of side play.

To use this tool, center lines are scribed as shown, crossing at the point that the axis of the connecting pipe is to intersect the outer surface of the larger pipe *H*. The dual points of the center rod are then set on one center line in positions that allow the rod to be pivoted in the same plane as the axis of the connecting pipe. The point of leg *B* is then positioned along the other center line and the center rod is set at the angle of intersection. After clamping the leg in place, arm *F* is adjusted so that the scriber will lay out the circumference of the desired hole. In scribing, arm *F* should always be rotated so that the scriber moves downward. This can be accomplished by laying out the hole in four sections, starting at the top of the pipe in each case.



Device that can be used to lay out holes for the joining of pipes intersecting at various angles.



IN SHOPS AROUND THE COUNTRY

Camera highlights of some interesting operations performed in various metalworking plants

AUTOMATIC RIVETING—A wing panel for the Convair 880 Jetliner moves through the jaws of one of four automatic riveting machines recently installed at the company's San Diego, Calif., plant to join the wing and fuselage skin to stringers. The riveters, designed and built by the Nuclear Products-Erco Division of ACF Industries, Inc., automatically drill and countersink the holes, insert the rivets, squeeze them, and shave off their heads. A positioner moves the work, determining hole location by template and electric-eye.

POST PUNCHER—From forty-five to seventy-one holes are pierced in bus-body posts on this machine, at work at Mack Trucks, Inc., Allentown, Pa. Punches are arranged in die sets, each of which is driven independently by a hydraulic cylinder. Designed and built by F. W. Armitage, Inc., the machine has a dual hydraulic system, and through micro switches, triggers each die set in sequence. In this way, the piercing has an ironing effect, assuring accuracy of hole locations.

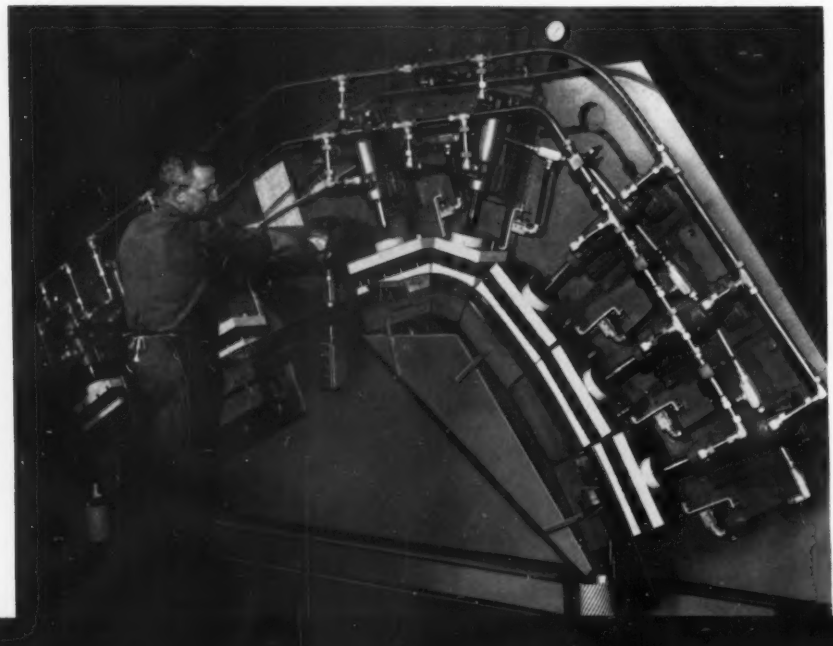
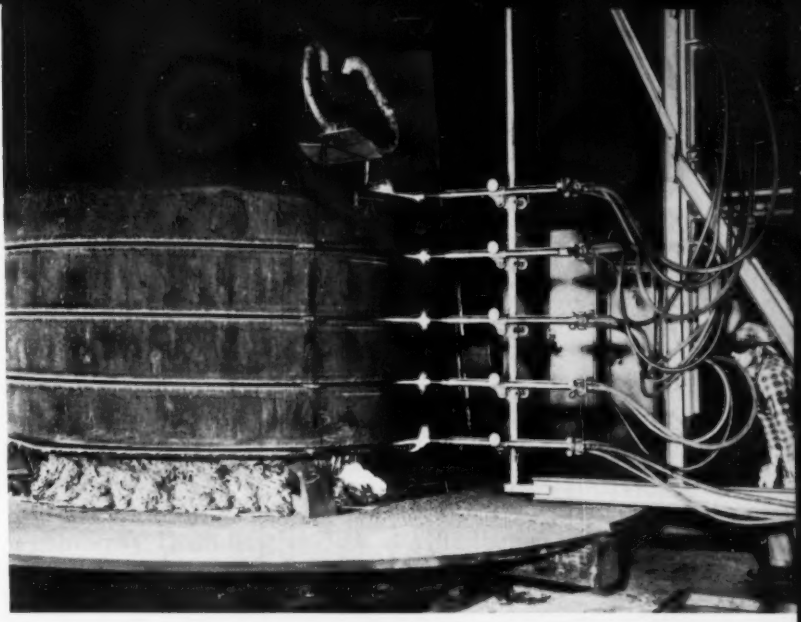
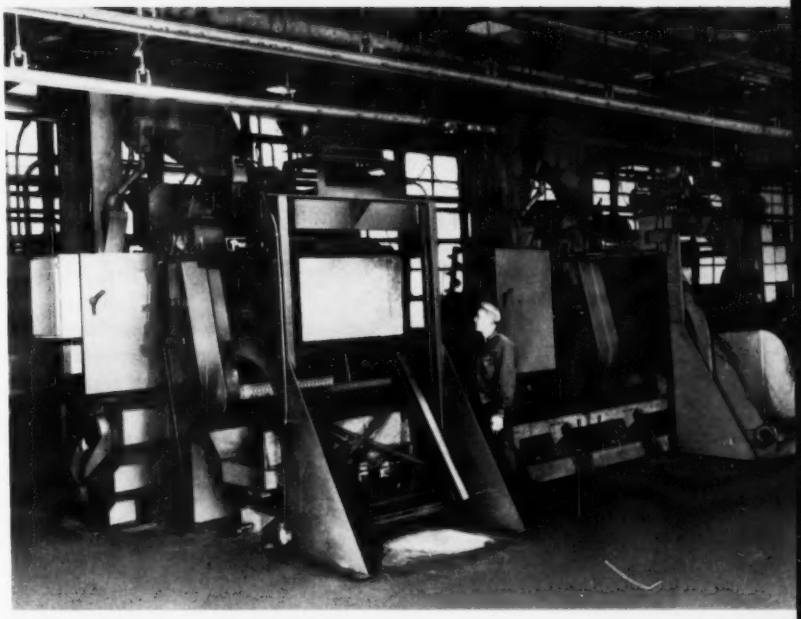


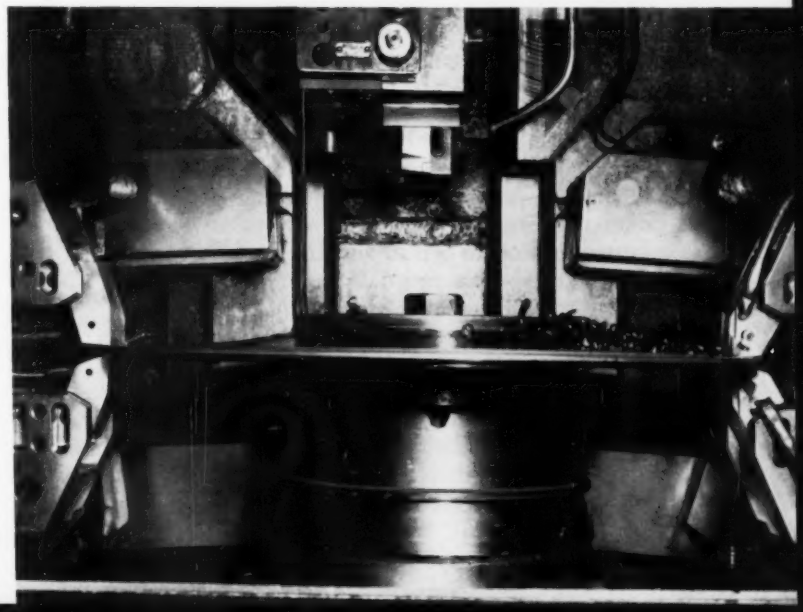
TABLE IS TURNED—In most flame-cutting operations, the cutting torches are moved over a stationary workpiece. But at the Midvale Heppenstall Co., Philadelphia, five Oxweld torches mounted on a vertical rig slice big forgings into rings as they rotate on a turntable. Torch carriers move on tracks that are radial to the table. Work up to 200 inches in diameter and weighing up to 120,000 pounds can be handled.

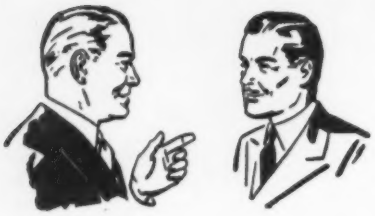


DOUBLE-BARRELED SHOT—These two 12-foot Rotoblast barrels clean 33 tons of gray-iron castings daily in the foundry of the Master Electric Co., division of the Reliance Electric & Engineering Co., Dayton, Ohio. Once loaded, the barrel doors close automatically and blasting action begins. After ten minutes, the doors open, and the work is discharged onto an oscillating conveyor. During the barrel operation, a cleaning and reclaiming system continuously removes scale and debris from the abrasive.



STRADDLE FACING—At the Wood-Ridge, N. J., plant of Curtiss Wright's Aeronautical Division, four tools simultaneously rough and semifinish both sides of 36-inch diameter jet compressor discs. A savings of $1.40 per piece was made by substituting Kendex carbide throw-away inserts for other carbide inserts which required regrinding. Discs are 9840 steel, with a hardness of 26-32 Rockwell C.





Talking With Sales Managers

BERNARD LESTER
Management Consulting Engineer

How Does Your Marketing Committee Work?

HAVE YOU a sales or marketing committee which meets periodically? If so, how well does it work? And above all, have you checked its productivity in relation to easily overlooked hidden costs?

As the search for better business methods goes on, top officials differ widely in their estimate of the part that committees should take in an operating organization. One president of a machinery-building company states: "When it comes to committees of operating men, we find they don't work out. For instance, we got rid of our sales committee. Of course, I get department heads together." Another, "We place great reliance in our marketing committee for idea development as well as coordination."

In spite of diverse opinion, the marketing committee receives greater approval as corporations grow in size and the executive role is more narrowly channeled. There is abundant evidence, however, that a committee's functions must be defined and that it should be held accountable for decisions. Though records are essential, the less verbose, the better.

The worth of any marketing committee can be estimated from its effectiveness in four directions:

Generating and screening new ideas: Marketing committees succeed when creative; stimulating discussion begets new ideas. And the big question mark engraved on the page of every agenda makes it necessary to equate every suggestion in terms of an increase in profitable sales or a decrease in direct and indirect expenses.

Investigating or fact finding: This applies especially to prospective policies, operating plans of broad concern and new fields of endeavor. Committees can make depth soundings and come up with balanced recommendations.

Promoting the acceptance of an adopted policy or plan: Since members of the committee occupy different rooms in the marketing house, each can help bring support to a joint program, as well as spot reasons for non-acceptance.

Exchanging information—sharing of viewpoint: Since most committee members are operating men, each member can be helped. Concentrating much in one field, a man needs occasionally to lift his sights and broaden his vision.

Thus, the committee really works when it yields fresh ideas, investigates situations, helps gain wide acceptance, and exchanges the fruits of experience. It commonly fails when it attempts to make executive decisions and to administer them.

Beware! No scheduled gathering of sales people can more easily slide into a soft rut or snowbank than the marketing committee meeting. Again, it may race downhill!

One strong and dominating personality may assume control. Those endowed with less wits but more wisdom may get shoved aside.

Vexatious decisions may be reached by the political route, and it is quite possible for one vote to alter the complexion and conclusion of a report.

There is a pressing tendency to load the agenda with minute details or opinions that are based on someone's pet peeve.

Managers may attempt to use the marketing committee as an escape in reaching a decision which should be squarely up to them.

Too often the marketing committee is ineffective because it sinks to the level of an afternoon tea at which matters are hashed over to the gratification of those present.

Experience shows these to be safe rules to follow:

Define the purpose of the committee.

See that live, well-informed, and balanced persons represent each branch of marketing.

Insist that the agenda contain items of consequence.

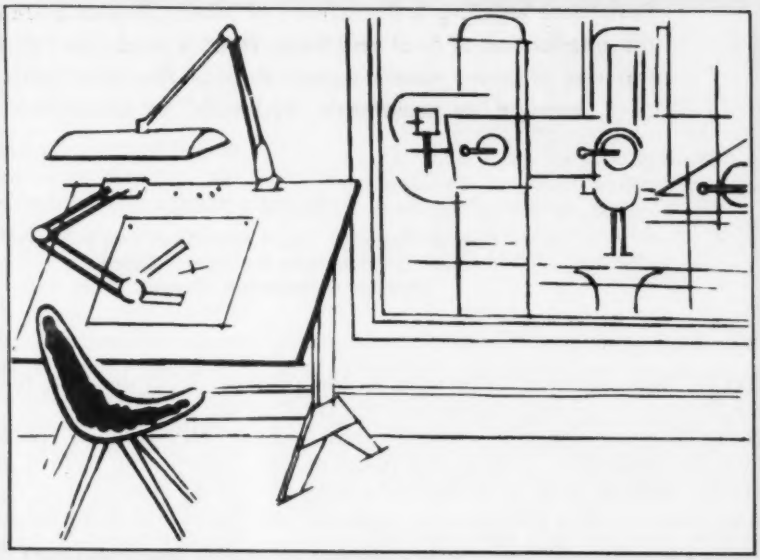
Encourage brief and orderly minutes and topical reports.

Support the committee with suggestions, not commands.

Test the returns of your marketing committee and calculate its real cost, as well as its enormous potential in the direction of savings, profits, and growth.

MACHINERY'S

Reference Section



WHAT THE DESIGNER SHOULD KNOW ABOUT PRODUCTION

PART 5—RESISTANCE WELDING

February 1959

What the designer should know about production — Part 5

RESISTANCE WELDING

Resistance welding is the science of joining two or more metal parts by the application of heat and force. Heat is produced by resistance to the passage of heavy electric current through the metal parts, while force is applied by pneumatic, hydraulic, or mechanical means.

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Staff Master Mechanics Office
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DESPITE their obvious differences to the observer, resistance welding and age-old blacksmith forge welding are basically similar in that both require the application of heat and pressure. In resistance welding, heat is not obtained from an external source, but is provided by resistance of the metal parts to the flow of electric current from electrodes in the form of copper or copper-alloy rods, dies, or rolls. The "forging action," or force, is provided by these same electrodes, and the resulting joint is at least equal in strength to the parent metal. A simple resistance-welding setup is illustrated in Fig. 1.

The amount of current required to produce the necessary welding heat is in the order of thousands of amperes. It is usually supplied by means of a transformer that changes the high-voltage, low-amperage power-line supply to a very high-amperage, low-voltage welding-current supply. Pressure to complete a resistance weld may be applied by either pneumatic or hydraulic cylinders, or by motor-driven cam units.

There are four major types of resistance welds. Divided along the lines of techniques involved and equipment used, they are classified as spot, seam, projection, and butt. The last-mentioned type may take the form of an upset-butt or a flash-butt weld.

Spot Welding Finds Broad Usage

Spot welding is the most widely used of all the resistance-welding processes. Because of its versatility it offers perhaps one of the most advantageous methods of reducing manufacturing costs while, at the same time, improving the quality of the product.

This form of resistance welding is so named because the weld is in the form of a "spot." Size of the spot, or nugget, is dependent on the thickness of the metal to be welded and on the strength desired. To produce a spot weld, electrodes are brought in contact with an overlapping portion of two pieces of metal. A specific pressure is applied, a definite electric current is caused to flow for a precise length of time, and the weld is made. After this, the electrodes are released. As most welds of this type are made on stationary machines, the circuit of a basic spot-welding installation is shown schematically in Fig. 2.

Four basic, successive stages are involved in making a spot weld and, generally, are automatically governed by an electrical sequence control and an electrical contactor. Illustrated in Fig. 3, they are:

1. Squeeze time: the time interval between application of electrode force to the work and application of welding current.

2. Weld time: the length of time that welding current flows through the circuit, usually expressed in cycles. If the welding current has a frequency of 60 cycles per second, a 10-cycle weld time would be equal to 1/6 second.

3. Hold time: that period during which pressure is maintained at the point of welding after current has ceased to flow. The hold time allows the weld nugget to cool.

4. Off time: the point, marking the end of the hold time, at which the pressure is released and the electrodes opened.

High production speeds are readily achieved with automatic, multiple-spot-welding machines. However, single-spot machines are still used for some sheet-metal job-shop applications.

Portable spot-welding machines are used to reach out-of-the-way locations or where the size of the assembly makes it difficult to bring the work to the machine. The welding head, or gun, may be of a standard design or may be specially built to fulfill certain job requirements. The most common application of the portable unit in the automobile industry is in the welding of large body components into a shell while they are positioned in a fixture.

Pulsation welding is a form of spot welding in which the current flow is interrupted more than once. The technique is employed when an adequate weld cannot be obtained with one period of continuous current flow. Not only can thicker parts be handled, but also steel scale and some other oxide coatings can be penetrated by the multiple impulses. Electrode life is lengthened by internal water cooling between weld cycles.

Edge distance is an important consideration in positioning spots. If placed too close to the part edge, expulsion of metal will result and weld strength will be impaired. The greatest strength per spot can be attained if they are spaced at intervals approximately equal to five times the weld diameter. Spots placed too closely will have a shunting effect on the applied current, Fig. 4, and will yield unit welds of reduced shear strength.

Generally, a spot weld is strongest under tension-shear loads. When peeling loads are applied, the weld will develop stress at its edge. Total shear strength of a structure can be increased by adding spots at proper intervals. Rows of spot welds can be added until the total shear strength of the joint is equal to that of the parent metal.

High joint efficiency is acquired in the following patterns:

1. Single row: spots are centered along joint and need the smallest amount of overlap.
2. Double row, straight: needs more overlap, but the load is more uniformly distributed.

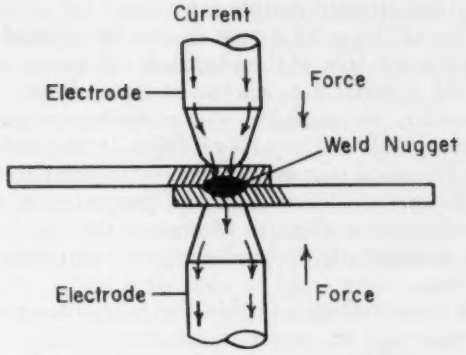


Fig. 1. Basic setup for joining sheet-metal parts by resistance welding. Heat is obtained by the resistance of the work-pieces to heavy current flow. Force is applied by the electrodes.

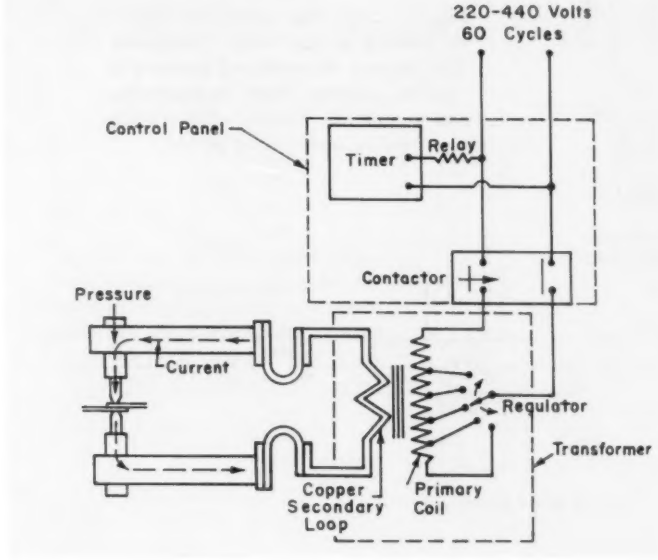


Fig. 2. Essential components of a stationary spot-welding machine. Heart of the unit is a transformer that changes a high-voltage, low-amperage input to a low-voltage output in the order of thousands of amperes.

3. Double row, staggered: needs less overlap than the straight double row.

Size of the weld nugget is directly affected by the contact area of the electrode tip. In essence, as the material gets thicker, so must the nugget diameter, to produce a commensurate shear strength. Although parts of different thicknesses can be joined in most commercial metals (similar or dissimilar), thicknesses and properties of the metals are important. In addition to this, the thermal conductivity and resistivity are determining factors.

In joining thick and thin sheets, caution must be exercised to secure satisfactory welds. The reason is that proper heat balance must be attained between the two pieces. When a considerable difference in thickness exists, heat developed at the interfaces may be insufficient to form a satisfactory weld due to losses from the thinner sheet into the cooled electrode. Compensation can be made by using an electrode having a smaller contact area on the thinner member as shown in Fig. 5.

Designing for Spot Welding

In designing for resistance welding, proper consideration must be given to many factors:

1. Type of process to be used—spot, projection, seam, or butt welding.
2. Type of material to be welded.
3. Type and direction of flanges (coach, lap, etc.) to be joined.
4. Size of flanges and number of spot welds.
5. Type of tooling and fixturing.

Consideration must also be given to the type of welding machine involved, with proper emphasis being placed on the requirements for retraction and movements. Whether the product is to be welded at high, medium, or low production rates, and the form of welding dies to be used in connection with the product must also be thought of. In general, attention must be given to every factor entering into good design in order to take full advantage of the engineering aspects and the production techniques of resistance welding.

Joints for Spot Welding—Various forms of joints are commonly used in spot welding. In a conventional coach joint, A, Fig. 6, the flanges are formed at a 90-degree angle to the surface of the parts being welded. Variations of the coach joint are shown, respectively, at B, a termination of flanges from curved surfaces; at C, a combination of coach joint and flat edge-surface which becomes a flange; and at D, a self-locating joint in which a fixturing advantage is obtained by pre-tooling consideration.

A typical lap joint with spot welds placed in the center of the overlapping edges is shown at E. At F the lap joint has an offset flange to provide surface continuity on one side of the two parts. Both parts at G have an offset flange to form a solder-fill joint which will be finished level with the surface for concealment.

Scalloped edges possess an advantage when welding three thicknesses of metal in a coach

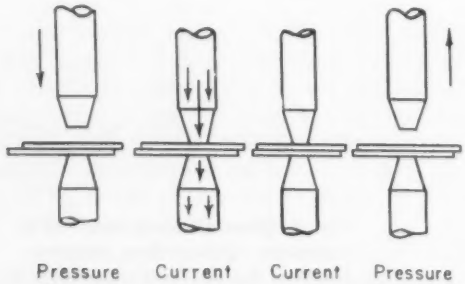


Fig. 3. (Left) Four successive stages in making a spot weld. Electrodes first contact the work and pressure is applied, current flows momentarily, and pressure is released after a brief holding and cooling period.

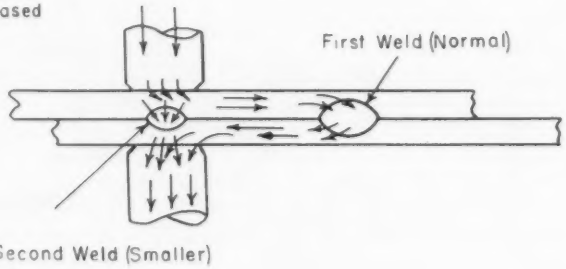


Fig. 4. (Right) To obtain the greatest strength per spot, welds should be spaced at sufficiently large intervals. If too close, a shunting of the applied current will result, yielding welds of reduced strength.

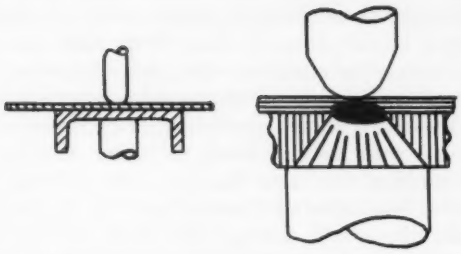


Fig. 5. Care must be exercised, when spot-welding parts of substantially different thicknesses, that proper heat balance be attained. To prevent excessive heat losses from the thinner piece into the cooled electrode, a smaller contact area should be used at this point.

joint, Fig. 7. The scallops permit the welding of alternate spots, or those occurring in two thicknesses only. Sheet-metal panels Nos. 1 and 2 are usually welded first, with spots being placed on the protruding scallops. Panel No. 3 is added last and is joined to panel No. 2 by spots located between the scallops.

Seven different joint designs—all representative of those used on existing products or parts, and all having flanges of equal size but in varied arrangements—are shown in Fig. 8. The exposed coach type joint at A allows immediate accessibility for straight welding electrodes. The parts are identical and relatively self-locating at the edges of the flanges. Simple welding jigs are used to locate and clamp from both ends, and the upper and lower electrodes can be both symmetrical and identical.

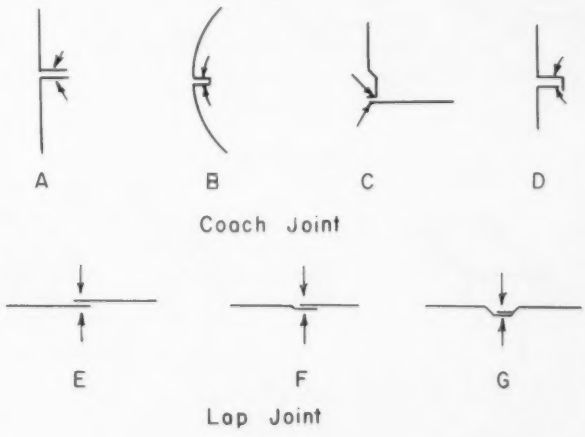
Flanges on the parts at B and C are similar to those at A. However, the upper electrodes would need to be longer than the lower electrodes to provide holder clearance. The flanges are simple and accessible, and the use of a flat electrode on the bottom surface will assure freedom from indentation, discoloration, and markings.

The condition changes greatly with the part illustrated at D, even though two rows of spots (as at C) are still specified. Here, the outer electrode can be straight, but the inner one must be offset because of the restricted space between the joints. When both rows of spots are welded on the same machine, the parts must be turned over to use the combination of one straight and one offset electrode. If both electrodes are offset the parts need not be reversed; but offset electrodes have a shorter life and need greater maintenance.

At E the condition becomes more difficult because a long, slender, and correspondingly weak electrode must be used with reduced pressure, thus producing a weld of lesser quality. An alternate method would be to insert a copper arbor between the inner surfaces of the enclosure so that a standard electrode could be applied on the outside of the part, eliminating the need for a special inner electrode. An objection here is that difficulty would be encountered when removing the inner copper form after welding.

At F the condition is further aggravated by attempting to weld two rows under the same conditions as at E. However, the joints at F can be welded in one of two ways; the two channels can be welded to one of the flat pieces in one operation, with the remaining flat piece being subsequently welded in the same manner as at E. The alternative is to place a copper form within the enclosure and weld both rows of spots simultaneously with opposed electrodes. Again, difficulty will be encountered in removing the copper form.

Fig. 6. Two of the several families of joints commonly used for spot-welding applications. A coach joint and its modifications are at A through D; various lap joints are at E through G.



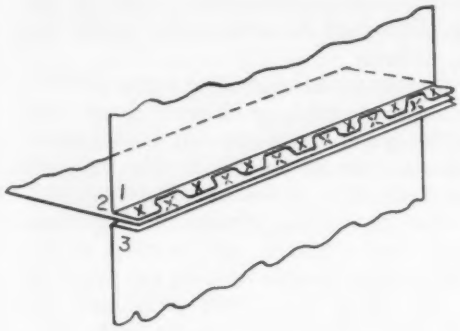
The condition at G is one of greater complication, and an unnecessarily large number of parts are used to make up the assembly. Straight electrodes applied on opposite sides of the part, together with an internal copper form, would be used to make two rows of overlapping spot welds simultaneously. It should be realized that if the parts illustrated in the last three cases were of curved rather than straight sections, removal of the copper form would be almost impossible. It would therefore be necessary to insert special electrodes from both ends of parts in order to reach the center weld with a sufficient amount of electrode force.

Spot-Welding Techniques—When designing for spot welding it is necessary not only that the spots be located, but also that specifications be made as to the employment of direct, series, or indirect welding, and whether to use standard, special, or portable machines. Illustrated in Fig. 9 are the three basic types of spot-welding setups.

In a series weld, the current flows from one electrode, through both metal parts, and into a copper backup block. It then flows back through both metal parts and into the other electrode, thus making two welds simultaneously, as in View A. At View B is shown another type of series weld, using a split backup block, in which four welds are made at the same time. In a direct weld the current is conducted directly from the upper electrode, die, or roll, through the work and into the opposite electrode, die, roll, or copper backup block.

Indirect welds derive their name from the path in which the current is made to flow. The current passes indirectly from one electrode, through the first part, and into the second part. It then takes one of two return paths; either passing through to a copper backup block as at View C, or continuing through the second part as at View D. In either case, it is conducted back to the transformer terminal by a copper contact block resting on the

Fig. 7. (Right) Scalloped edge is provided on panel No. 1 of a coach joint consisting of three thicknesses of metal. Alternate spots can thus be welded in two thicknesses of metal only.



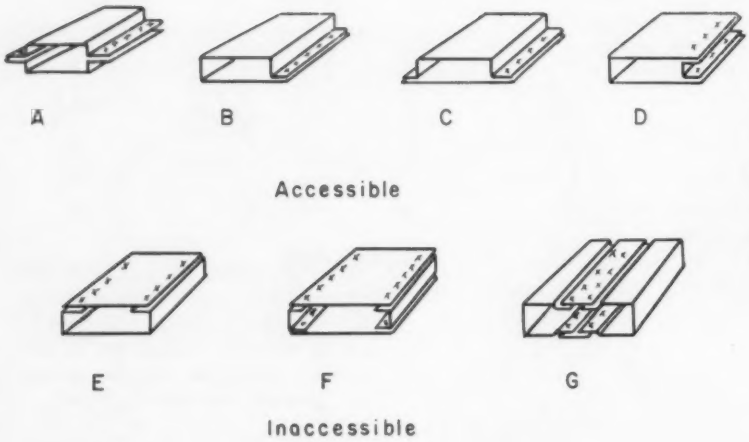


Fig. 8. (Left) Seven different joint designs (representing those used on existing parts) having flanges of equal size. Those from A to D are accessible for spot-welding, while the remaining three designs present difficulties.

same side of the assembly as the electrode. This technique bears some resemblance to a series weld circuit and often is mistaken for it.

It is usually difficult, and often impossible, to weld flat sheets to thin-wall, round, or square tubing. The result will be a collapse of the tube surface. On the other hand, a thin part can be satisfactorily spot-welded to thick-wall tubing without danger of collapse and without a backup block.

Component design is influenced by the type of equipment to be used for welding. For example, joining of the two channel-shaped stampings shown in Fig. 10 is accomplished by spot-welding one horizontal and two vertical flanges.

The flanges should be turned to the outside, as at View A, if the weld is to be made by a special, automatic welding machine. If the flanges were turned inward, interference of the fixed electrode cluster would prevent the welding of all spots in one operation. A copper backup block can be inserted in the channel without interfering with the removal of parts from the dies. (For simplicity of illustration, the assemblies are upside down to show the construction.)

If welding is to be done by portable equipment it would be advantageous to turn all three flanges toward the inside as shown at View B. With only one major positioning, the portable welding gun can be placed at the starting point for the first spot, and each succeeding spot can be produced by moving the gun in a U-shaped path. In general, however, when portable guns are used for spot welding, the direction in which the flanges turn is relatively unimportant as long as they are readily accessible.

Projection Welding Akin to Spot Welding

Process Description—Projection welding is an extension of the spot-welding process. The principal difference lies in the placement of a protru-

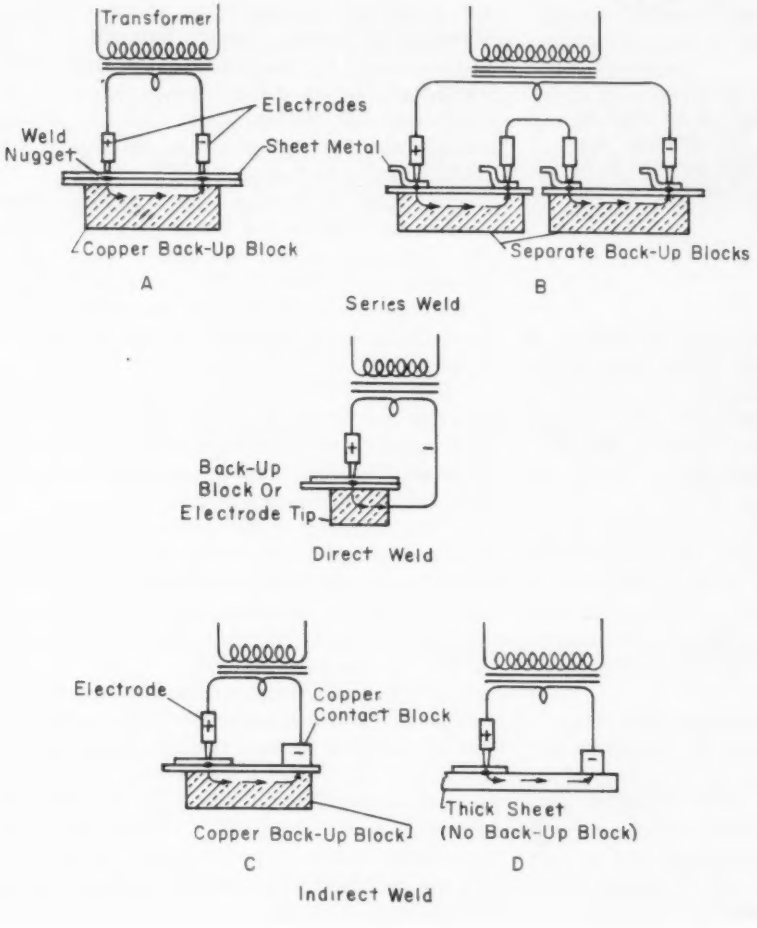


Fig. 9. Three types of spot-welding setups based on the handling of current flow. They are the series weld, top; direct weld, center; and indirect weld, bottom. Resemblance between the first and last techniques frequently results in mistaken identification.

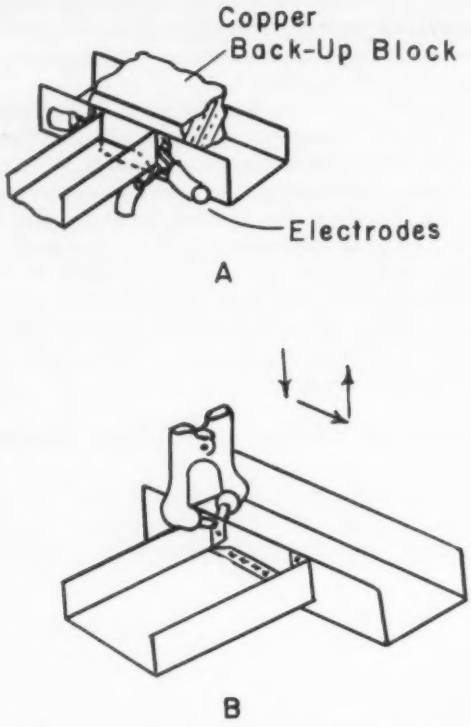


Fig. 10. Welding equipment to be used influences part design. For an automatic machine, flanges should be bent outward as at A; for a portable unit, they should be reversed as at B.

sion, projection, embossment, tab, or button at the designated weld location on the parts to be joined. This projection directs the current along a predetermined path and helps to assure a definite spot weld. When properly welded, the projections are flattened sufficiently to bring the work-pieces into contact, Fig. 11.

In projection welding, external pressure is applied by relatively large copper-alloy contacting surfaces—either in the form of flat electrodes or dies—instead of electrodes such as are used in spot welding. An immediate advantage is obtained in the much longer production life of these copper-alloy electrodes.

As a rule, parts welded by this method are provided with multiple projections. If projection design follows recommended practices, high production speed and strong welds can be obtained. This technique is especially effective where several welds are to be made in a small area, and is most often used to attach brackets and fasteners, or to join metal parts having inherent projections.

Application Pointers—When designing for the use of projection welding, rigidity of the projection to withstand die or electrode pressure must be considered. Also, if a weld of sufficient diameter is to be made, the projection must have enough mass.

Location of the projection is determined by the fundamental rules of heat transfer. When dissimilar metals are to be joined, it should be placed on the part having the highest electrical conductivity. When welding thin material to thick material, gage specifications of the thinner part for projection height and diameter should be applied. Always place the projection on the thicker part.

Different problems arise with each different metal to be joined. For example, projection welding of brass and aluminum is limited to a few nonstructural applications, while similar joining of copper is impractical because of its softness and low electrical resistance.

Three basic projections that are most generally used are the button, the cone, and the spherical types, as illustrated at the top of Fig. 12. The button projection is employed when welding flat sheets in thicknesses ranging from 24 to 13 gage, or in decimal dimensions ranging from 0.025 to 0.093 inch. Because the cone projection is more rigid than the button, it is used for projection welding sheets ranging in thickness from 12 gage (0.1093 inch) to 5 gage (0.218 inch).

The third projection, the spherical type, is used in the welding of heavy sections, forgings, etc. A cavity, called the relief, surrounds the spherical projection. As the metal from the projection reaches a plastic state it can flow into this area. The relief is necessary to prevent sheet separation.

Other types of projections have been designed to serve special functions in the welding of particular parts. One such type is the ring projection (bottom, Fig. 12). This is generally used to join rods, tubes, and similar parts.

In Fig. 13 is shown the projection welding of a bracket to a rear-axle housing, in which consideration of two techniques is presented. Better welding and reduced operating time is gained by the method shown at View B, making it the more desirable of the two. At View A the bracket is clamped between a pair of die jaws (electrodes). Too much time is required with this setup as the bracket must be located and clamped before the welding ram can be lowered into position and the weld made. Unclamping must then take place before the ram can be raised. On the other hand, the bracket at B is quickly welded by direct contact and without the need of manual clamping and unclamping steps.

Seam Welding—
Resistance Welding with Rolls

Process Description—Seam welding is generally performed on a resistance-welding machine that is equipped with electrodes in the form of rolls. These rolls travel along the flanges to be joined at controlled speeds and at a constant pressure. Instead of individual electrodes opening and closing as on spot-welding machines, current is interrupted at high speeds and at various intervals to produce different types of seams.

Seam welds may be made in several ways, depending upon the technique followed in controlling the flow, duration, and interruption of welding current through the rolls and into the work. Rotation of the rolls, together with short-duration weld and off times, causes an overlapping, or chain, effect of individual spot welds. It results in a joint that is both gas- and water-tight. Surface speed of the roll is the product of the number of spots per inch and the weld time necessary to produce a quality weld.

When the weld nuggets do not overlap, the process is known as roll-spot welding. The strength of the joint produced is equivalent to a row of welds made with spot-welding electrodes. Because it presents a controlled means of locating spot welds, it is presently used on automobile bodies—for example, in joining the roof panel to the drip molding with a portable seam welder.

Mash welding is another form of seam welding. In Fig. 14 (where both methods are compared it can be seen that a minimum overlap of material is maintained for mash welding—ordinarily from one-half to twice the thickness of one metal sheet. The circular electrodes mash, or flatten, the plastic weld metal while current flows and high electrode pressure is exerted.

A mash-welded seam is slightly thicker than one sheet of the welded material. Also, distortion is held to a minimum. There is little external evidence of the path taken by the electrodes, so that little finishing is required to obtain a flush surface.

Proper joint design will provide considerable savings if the edge distance of the seam and the clearance of the work can accommodate standard secondary arms and electrode rolls. Water cooling (whether internal, external, or a combination of both) improves the weld appearance and quality, and prolongs wheel life. Surface heat is readily dissipated, and warping of the work-piece is retarded.

Application Pointers—Design considerations for seam welding are in some ways similar to those for spot welding. This is true when coach- and lap-joint flanges that are to be joined by one particular method or the other have equally accessible locations.

As illustrated by the rectangular parts at View A in Fig. 15, proper location of the weld line is important. The seam weld is positioned in the center of the left-hand part, permitting the use of a standard lower arm as well as standard elec-

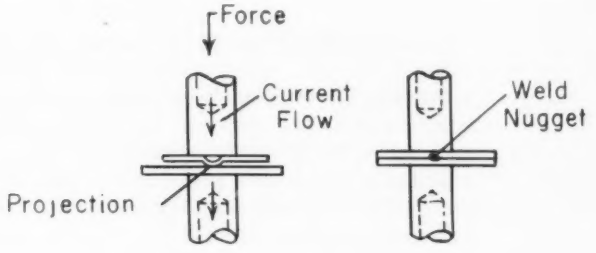


Fig. 11. (Left) In projection welding, one or more embossments are provided at the desired joint location. During a properly executed weld cycle, the projections are flattened and the work-pieces are brought into contact.

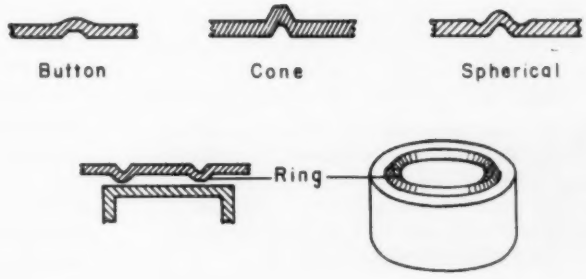


Fig. 12. (Right) Button, cone, and spherical are the three types of projections most commonly used. For joining such parts as rods and tubes, the ring projection is generally employed.

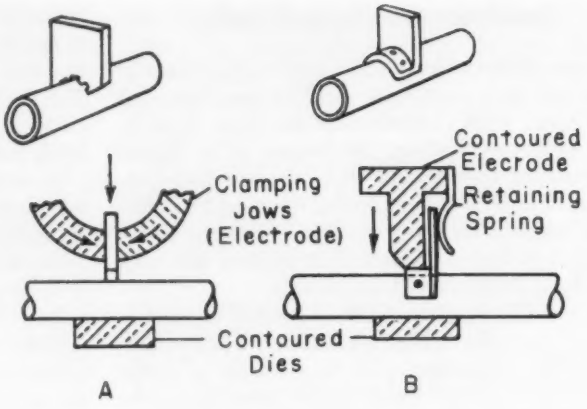


Fig. 13. Either of these two techniques for welding a bracket to a cylindrical housing can be employed. However, the design shown at B is preferable because of reduced operating time and better weld quality.

trode rolls. On the other hand, the seam weld of the right-hand part is located close to an edge, requiring either a special copper-alloy mandrel or an offset welding arm. This is a mechanical disadvantage and designs requiring such tooling should be avoided wherever possible.

Seam welding is extensively employed in the fabrication of fuel tanks. In this application there are several ways of handling the corners of the flanges to obtain a leakproof joint. The square-cornered flange treatment on the left-hand tank at View B, Fig. 15, permits the rolls to run off the edges in one direction, after which the tank is turned 90 degrees and reinserted for welding the next flange.

A conventional corner treatment of gasoline-tank flanges is shown at the right. Here, the wheels follow the rounded corners of the tank and weld the flange close to the vertical sides. Although contours of tanks may vary widely, there should be no concave areas in the flange lines. The principles involved in seam welding materials of different thicknesses are similar to those involved in spot welding under the same conditions.

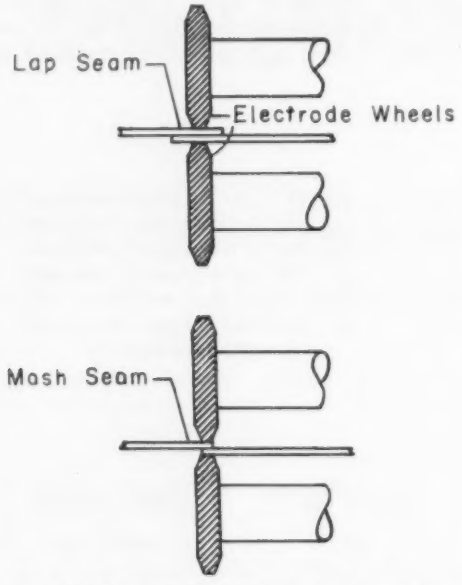


Fig. 14. Two seam-welding techniques using circular electrodes are compared. In conventional seam welding, top, a standard lap joint is used. Mash welding, bottom, requires a minimum overlap and high electrode pressure to flatten the plastic weld metal.

Flash-Butt Welding Has Different Approach

Process Description—Flash-butt welding is a resistance-welding process for the end-to-end joining of rods, tubes, bars, forgings, fittings, etc., to achieve the greatest possible strength. It is accomplished by positioning the pieces to be joined with clamping electrodes so that there is, initially, light contact between abutting surfaces.

Introduction of a heavy current flow causes flashing, which generates great heat. As the metal is burned away, the pieces are fed toward each other with a carefully controlled, accelerating motion. In this way, a uniform flashing action is maintained and efficient heating results.

When the inner faces reach the proper temperature, they are forced together under high pressure and the current is cut off. Impurities such as oxides and slag, formed during flashing, are forced out in the upset action, leaving pure base metal to form a high-strength bond. Phases of a flash-butt welding cycle are illustrated in Fig. 16: at A, work-pieces are clamped by elec-

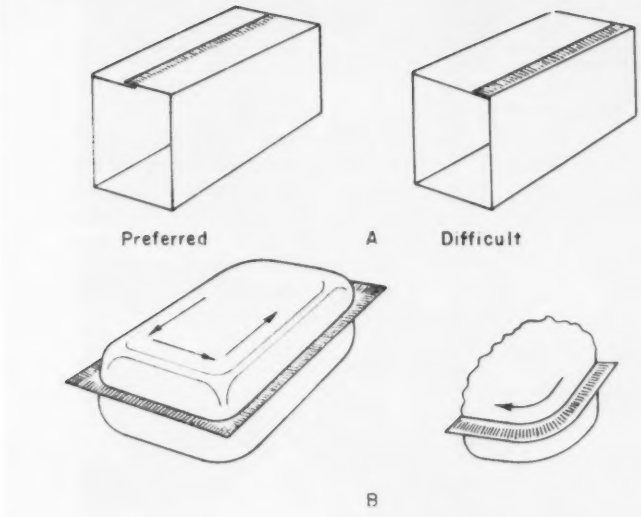


Fig. 15. Seam-weld location is important. At A, the right-hand joint requires special tooling. At B are two ways of seam-welding tank sections. Electrodes run off each of the square corners, left, but follow the round corner, right.

trodes; B, flashing is established as parts are brought into contact; C, intense heat is generated by arcing between parts; D, upset pressure is applied; E, joint can be blended with adjacent surfaces by machining. Sheet-metal parts can be flash-welded as easily as can solid bars, structural sections, tubing, or forgings, although a slightly different clamping technique is required.

Application Pointers—Designing for flash-butt welding falls in a category apart from designing for the other types of resistance welding. This is due to the entirely different approach to the process of welding and to the type of joint for which it is best suited.

A basic rule for flash-butt welding is that the weld sections be identical in size and shape for heat balance. At View A in Fig. 17 is shown a length of tubing that is to be welded to a solid metal block of considerably greater mass. This represents a poor condition. Heat from the flash will quickly raise the surface of the smaller part to the correct temperature and bring the surrounding area to a plastic state. In contrast, the larger mass will rapidly dissipate the developed heat, leaving only a small and thinly heated area at the joint. Consequently, it will not reach the proper welding temperature, eliminating all possibility of obtaining a good joint between the two parts.

Improved joint design—the matching of sections as shown at View B—will remedy this situation. Correct heat balance has now been obtained in which the plastic zones surrounding the two

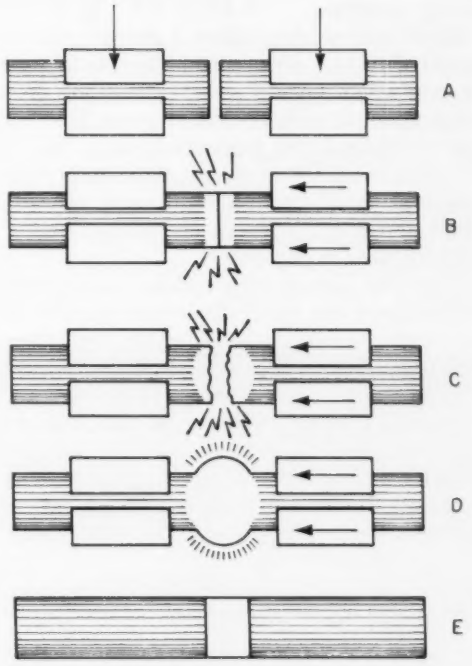


Fig. 16. Steps involved in completing a flash-butt-welded joint. The parts are clamped by electrodes, contact each other, strike an arc, and, at the correct temperature, are forced together. Upset area can be machined flush.

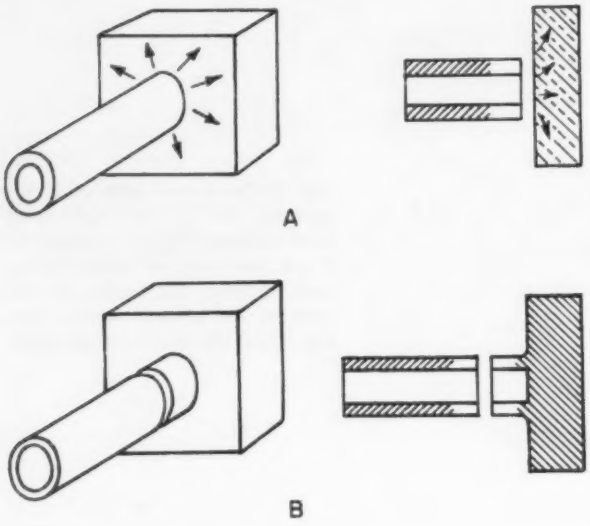


Fig. 17. Proper heat balance between sections to be flash-butt-welded is essential. At A, heat will quickly dissipate into the large block, leaving a low-temperature weld area. Redesigned joint, at B, provides necessary heat balance.

abutting surfaces are equal. By this treatment the welding temperature of both parts is reached simultaneously, and each will have an equally deep plastic zone, so that a sound weld will be obtained during upsetting.

Flash-butt welding offers a strength-factor potential of 100 per cent, as compared to 80 per cent for most other types of welding. Further, no additional material such as shielding gas, filler rod, or flux is required—the work itself forms the weld. The process has low power demand and consumption, and good production speeds are readily achieved. Generally, no special preparation of the weld surfaces is required.

Dissimilar metals with widely varying melting temperatures are easily flash-butt-welded. However, some general considerations for obtaining a satisfactory flash-welded joint are as follows:

1. Uniform heat balance in the parts—their weld areas should have the same size and shape. However, a maximum of 15 per cent variation in end dimension is usually permissible for commercial usage. If different materials are to be joined, heat balance can often be obtained by varying the overhang of one of the parts.

2. Excess material length must be provided for flashing and upsetting. This "burn off" will vary with the type of material being welded and with its section dimensions.

3. The welded area will be larger than the original section and may have to be trimmed, depending on the particular application.

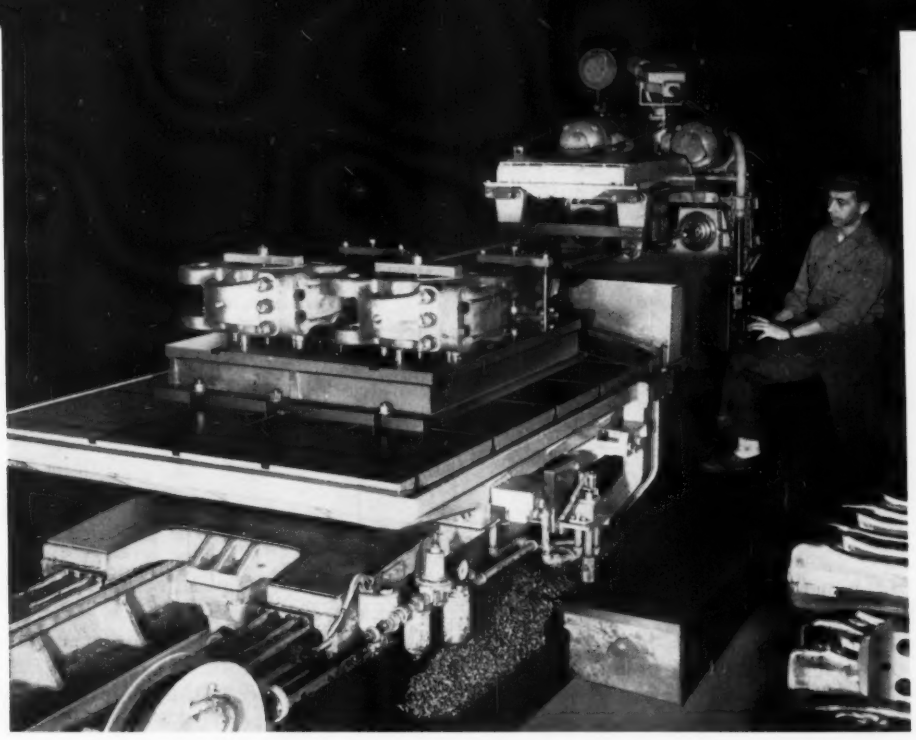
4. A clear area on the work-pieces should be provided relatively close to the weld zone to accommodate the clamping dies. These dies can be contoured if required. Also, the parts must have clean contact surfaces of sufficient area for current flow.

5. Flash-butt-welding machines in general, and their clamping systems in particular, are designed around the parts being joined. If the parts are simple, such as bars or tubes, easily replaceable inserts are provided to handle a wide range of diameters. If the part is intricate, a complete die assembly must be designed.

6. Close tolerances, with regard to material loss and final part length, are easily maintained with the proper equipment. Variations in part length are usually less than the tolerance of the individual pieces being welded.

REFERENCE

Resistance Welding—W. A. Stanley, published by the McGraw-Hill Book Co., Inc., New York, N. Y. (Out of print)



Drilling Oil Passages in Giant Connecting-Rods

C. J. SCHLICHT, Machine Designer
Cooper-Bessemer Corporation, Grove City, Pa.

A COMPANY-DEVELOPED machine equipped with target drills is producing long, straight oil passages in large connecting-rods at Cooper-Bessemer Corporation, Grove City, Pa. Inaccuracies normally associated with deep-hole drilling are minimized. At the same time, relatively high speeds and feeds and good surface finish are obtained without vibration.

The connecting-rods are for big gas and diesel engines and engine-driven compressors with ratings to 5000 hp. Some of the rods weigh as much as 1500 pounds, with a bearing center distance

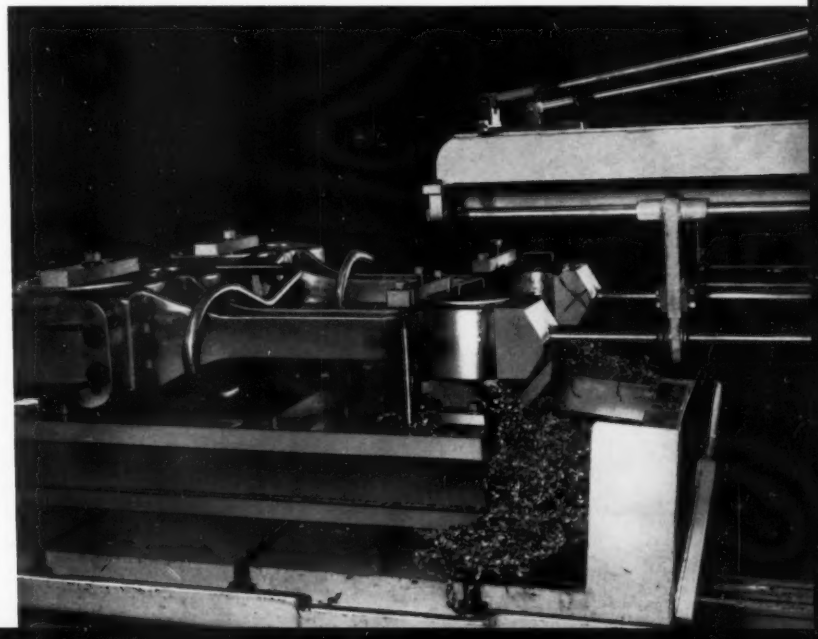


Fig. 1. The overhead brace and ball-bearing bracket assembly for preventing the drill shanks from whipping is an important feature of the machine.

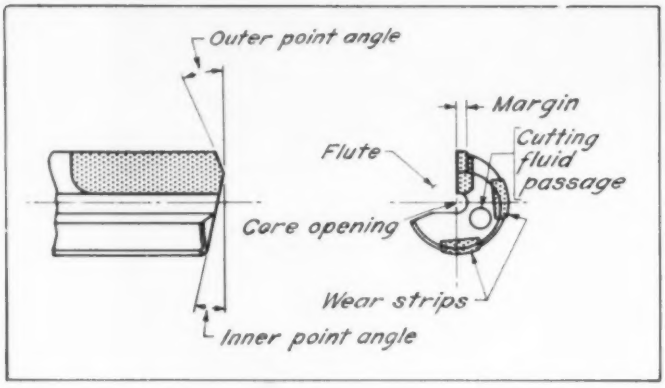


Fig. 2. (Left) The target drill trepans the hole, leaving a small core of material. End view shows hole through which cutting fluid flows from hollow shank.

Fig. 3. (Below) Wrist-pin hole of connecting-rod (C) is in position over jig plate (E), with target drill (A) ready to enter clearance hole (B).

of 62 inches. They are drilled two at a time by the two spindles of the machine, shown in the heading illustration.

A close-up view of the work area appears in Fig. 1. An overhead brace extending from the headstock supports a pair of ball-bearing brackets. The tubular drill shanks are contained in the brackets, and are thus prevented from whipping at high speed.

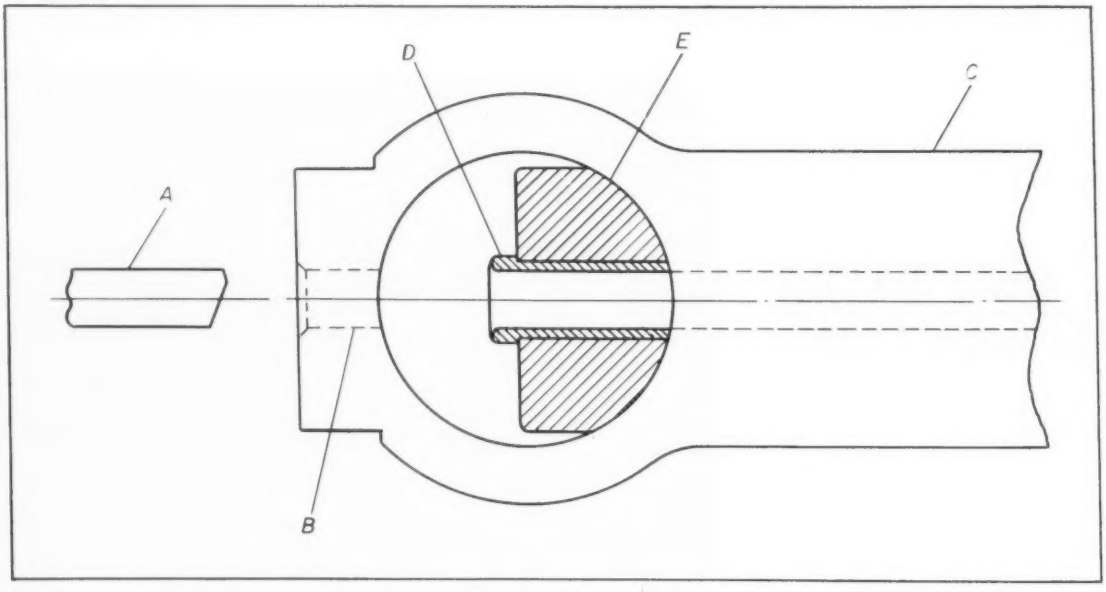
A drawing of one of the target drill points appears in Fig. 2. The cutting element is a flat piece of carbide. Instead of removing all the metal in the hole (as is true of a gun drill) the tool leaves a solid core of material around which it trepans. The core serves as a pilot, assuring that the tool follows a straight line—thus the term, "target."

In a preparatory operation, a clearance hole for the target drill is produced by conventional means from the piston end of the connecting-rod to the wrist-pin bore. Then, when the work is set up on the machine table, the wrist-pin bore is positioned over a jig plate which contains a bushing to guide the drill.

The drawing, Fig. 3, explains the function of this jig plate. Target drill *A* enters clearance hole *B* of connecting-rod *C*, then guides in bushing *D* pressed into jig plate *E*. The rear of the jig plate and the bushing are radiused to fit snugly against the wrist-pin bore of the connecting-rod. To locate the work, the jig plate is designed with an integral base which is bolted to the machine table, as can be seen in Fig. 1. In addition, the top of the base supports the underside of the connecting-rod.

In operation, the table traverses toward the headstock and starts to feed as the drills enter their respective jig-plate bushings. An Oilgear hydraulic system furnishes the table movement. Feed rates vary from 1 3/8 to 2 1/2 ipm (inches per minute), depending on hole diameter.

Spindles are of Cooper-Bessemer's own design and are mounted on roller bearings. Each spindle



is driven by a 10-hp motor. Speeds range from 450 to 2500 rpm. The spindles are hollow, with a rotary union at their rear to permit cutting oil to be introduced. Oil, under 500 psi pressure, flows through the spindle and drill shank, emerging through the passage in the drill tip seen in the drawing, Fig. 2.

The machine table is 5 by 7 feet, and has a longitudinal travel of 7 feet. In addition, it can be cross-indexed several inches, permitting connecting-rods requiring two oil passages each to be drilled in the same work setting.

Oil passages now being drilled range from 3/8 to 1 inch in diameter and are up to 70 inches in length. All of the target drills have been supplied by the National Twist Drill & Tool Co. On the basis of the proven performance of this machine, company plans now call for designing and building one with four spindles for other deep-hole drilling jobs.

"Squirt" Method Speeds "Finnish" Welding

Cost is a stern taskmaster in the manufacture of machine components, even in Karhula, Finland, where Ahlstrom Osakeyhtio makes feeding-furrows for wood-chipper machines. These are the odd-shaped frames seen in the process of assembly in the accompanying illustration. They are widely used in paper-mill operations throughout the world.

Originally designed as steel castings throughout, they were modified to arc-welded steel plate, primarily because of a shortage of foundry capacity. However, the change made reduced machining allowances possible, and the consequent savings in machining time resulted in a 30 per cent decrease in manufacturing costs.

All welding of the assembly was done at first by conventional manual techniques at a rate of forty-five hours per unit, using coated rod. However, introduction of "squirt" welding procedures employing equipment made by the Lincoln Electric Co. cut welding time to about twenty hours per unit. The use of manual welding is retained for preliminary tacking and occasionally for the root of a deep vee. All joints range in length from 14 to 154 inches and are completed by one or more passes with submerged arc "guns" operating at currents ranging from 475 to 600 amperes.

The weldments are comprised basically of 1-inch side plates, flame-cut to shape and incorporating a variety of cutouts, holes, and slots; 1-inch reinforcement plates on either side at one end; transverse ties of steel tubing and 1/2-inch plate; and bearing bosses of 6-inch tubing having a 1 1/2-inch wall thickness. Side plates are held in a positioner to facilitate downhand welding.

Weldments for wood-chipper machines being produced in Finland by the "squirt" technique.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Dimensioning Holes for a Jig-Boring Operation

W. W. JOHNSON, Cleveland, Ohio

On a certain machine member there are three rollers of equal diameter located at the vertices of an oblique triangle, as shown in Fig. 1. It is required to find the radius of a circle tangent to these rollers so that the center of this circle, as shown in Fig. 2, can then be used as the datum point from which coordinates for jig boring may be indicated on the drawing.

SOLUTION:

The formula for finding the radius of a circle circumscribed about a triangle is:

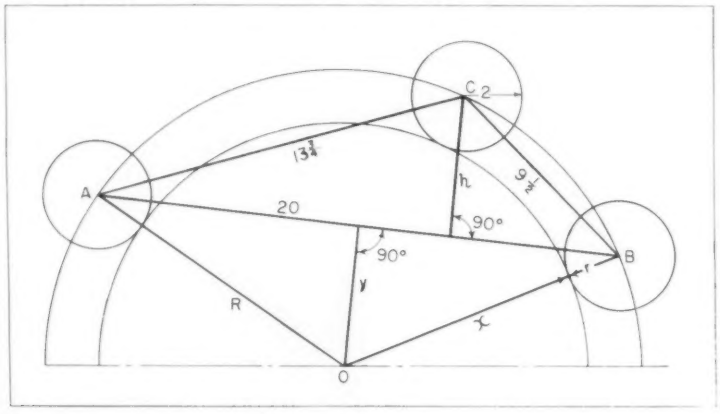


Fig. 1. (Right) Layout of three equal rollers at the vertices of an oblique triangle.

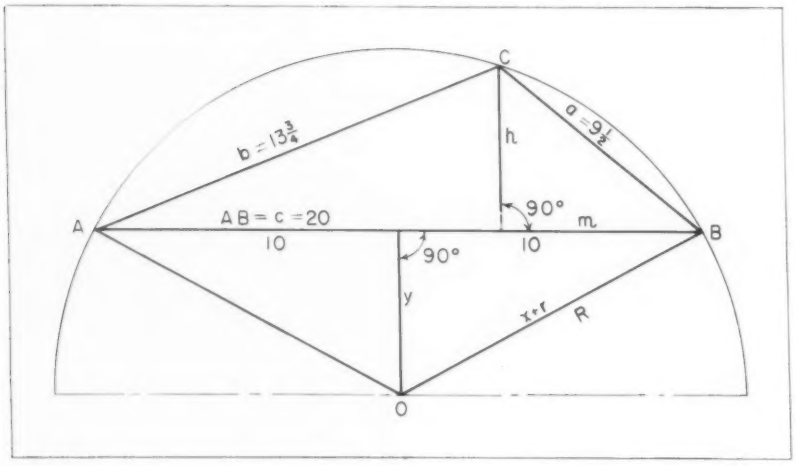


Fig. 2. (Left) When radius (R) has been calculated, the center (O) can be used as a datum point from which to specify jig-boring coordinates for points (A), (B), and (C).

$$R = \frac{a\,b\,c}{4\sqrt{s(s-a)(s-b)(s-c)}}$$

$$= \frac{a\,b\,c}{4\,K} \qquad (1)$$

In this formula, a, b, and c are the sides of the triangle and s is the semi-perimeter, $(a+b+c) \div 2$.

From Fig. 1, the sides a, b, and c are, respectively, 9 1/2, 13 3/4, and 20. The semi-perimeter s is therefore

$$\frac{9\ 1/2 + 13\ 3/4 + 20}{2} = 21.625$$

Then, using Formula (1),

$$R = \frac{a\,b\,c}{4\,K} = \frac{9\ 1/2 \times 13\ 3/4 \times 20}{4 \times 57.926}$$

$$= \frac{2612.5}{231.7} = 11.275$$

$$x = R - r = 11.275 - 2 = 9.275$$

$$y = \sqrt{R^2 - 10^2}$$

$$= \sqrt{(R+10)(R-10)}$$

$$= \sqrt{21.275 \times 1.275} = \sqrt{27.126}$$

$$= 5.208$$

From geometry,

$$h = \frac{2}{c}\sqrt{s(s-a)(s-b)(s-c)}$$

$$= \frac{2 \times 57.926}{20} = 5.793$$

$$m = \sqrt{a^2 - h^2}$$

$$= \sqrt{(9.5 + h)(9.5 - h)}$$

$$= \sqrt{15.293 \times 3.707}$$

$$= \sqrt{56.691}$$

$$= 7.529$$

Calculating the Angle on a Punch

W. W. JOHNSON, Cleveland, Ohio

The angle A on the piercing punch illustrated in Fig. 1 was calculated, using the diagram in Fig. 2, as follows:

SOLUTION:

$$m + n = 4\frac{1}{4} = \frac{17}{4}\text{; also, } \frac{1}{2}\left(1\frac{1}{2} - 1\frac{3}{16}\right) = \frac{5}{32}$$

$$m = \frac{1/2}{\sin\phi} = \frac{1}{2\sin\phi}$$

$$n = \frac{5}{32}\cot\phi$$

Then,
$$\frac{1}{2\sin\phi} + \frac{5\cot\phi}{32} = \frac{17}{4}$$

$$16 + 5\cot\phi\sin\phi = 136\sin\phi, \text{ or,}$$

$$136\sin\phi - 5\cos\phi = 16.$$

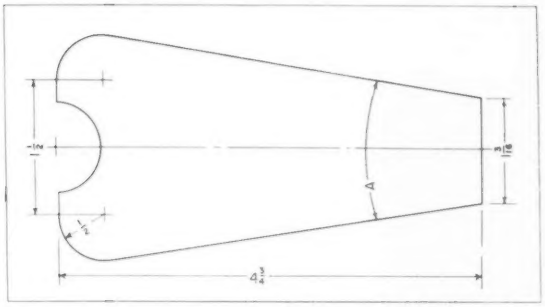


Fig. 1. Piercing punch for which angle (A) must be calculated.

This equation is of the form $a\sin\phi - b\cos\phi = c$ which was discussed in the August, 1958, issue of MACHINERY.

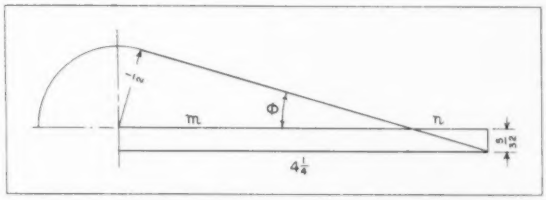


Fig. 2. Layout used in calculating angle (A) on piercing punch of Fig. 1.

Let
$$\tan\beta = \frac{b}{a} = \frac{5}{136} = 0.0367647$$

$$\beta = 2^\circ\ 6'\ 20''.$$

Then,
$$\sin(\phi - \beta) = \frac{c}{b}\sin\beta$$

$$= \frac{16\sin 2°6'20''}{5}$$

$$\sin(\phi - \beta) = 3.2\ (0.0367406)$$

$$= 0.1175699$$

$$\phi - \beta = 6^\circ\ 45'\ 6''$$

$$\beta = 2^\circ\ 6'\ 20''$$

$$\phi = 8^\circ\ 51'\ 26''$$

Since
$$2\phi = A$$

$$A = 17^\circ\ 42'\ 52''$$

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts, and

Burgmaster Multiple-Spindle Turret Drilling, Tapping, and Boring Machines Equipped with G-E Tape Control

G-E numerical tape control provides flexible automation for small-lot machining on Burgmaster six- and eight-spindle turret drilling, tapping, and boring machines (Fig. 1) built by the Burg Tool Mfg. Co., Inc., Gardena, Calif. Short production runs of many different parts can now be handled economically on these fully automated units.

Changing of the machine setup to accommodate a different part is quickly accomplished. Only simple holding clamps and standard tools are used. Simplified tooling eliminates expensive fixtures and requires no drill bushings. The punched tapes can be quickly corrected, eliminating expensive reworking of tools in case of design changes.

Only semi-skilled labor is required to operate this equipment, which is said to reduce work spoilage to minimum. Accuracy of hole location is automatically controlled to ± 0.001 inch and the accuracy of repeat operations can be held within ± 0.0005 inch without using bushings. Feeds and speeds are pre-selected for greatest efficiency, thus increasing tool life as well as the production rate. The machines are simple to program and preparation of the tape is easily and quickly accomplished by using the Flexowriter typewriter, shown in Fig. 2. Center dimensions are automatically controlled. One operator can easily run two or more machines.

The Burgmaster-GE numerical control system is of the automatic, punched-tape type which positions the table on two axes and operates the hydraulic turret drill to carry out a predetermined sequence of operations. These may include drilling, boring, tapping, reaming, counterboring, and spot-facing to extremely close tolerances with the simplest of tooling. This combination of electronic and hydraulic controls is designed to provide the ultimate in flexibility, resulting in a machine that can be used economically for everything from prototype to high-production work. The standard Burgmaster controls are maintained. These include pre-selective spindle speeds, infinitely variable pre-selective feeds, selective rapid approach and return, precision depth control, and simple manual controls for setup.

The numerical system automatically controls all the machine functions. It positions the table, indexes the turret in any sequence, clamps the table in position while machining operations are being performed, and controls many auxiliary functions, such as turning the coolant on and off. Provisions for blowing off chips, indexing fixtures, and so forth, are optional at extra cost.

When programming a part, it is always necessary to determine the starting position from which all holes will be located or referenced. A keyway is provided on the center line of the table which, if a key is used in the fixture, will automatically determine the reference in the "B" axis. An end-stop in the table or a target bushing in the holding device will determine

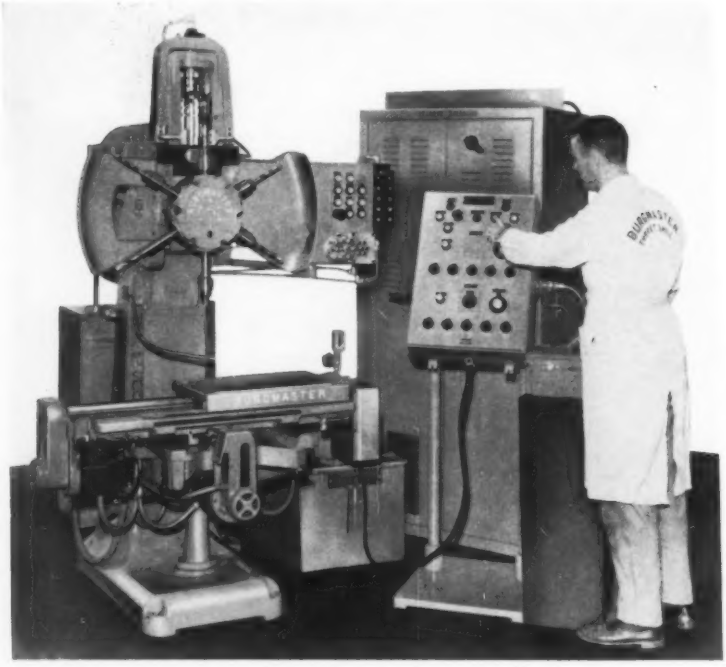


Fig. 1. Burgmaster six-spindle turret drilling, tapping, and boring machine with G-E numerical tape-control system

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

Fig. 2. Flexowriter which makes it possible for a typist to prepare quickly the tape used for automatic control of machine shown in Fig. 1

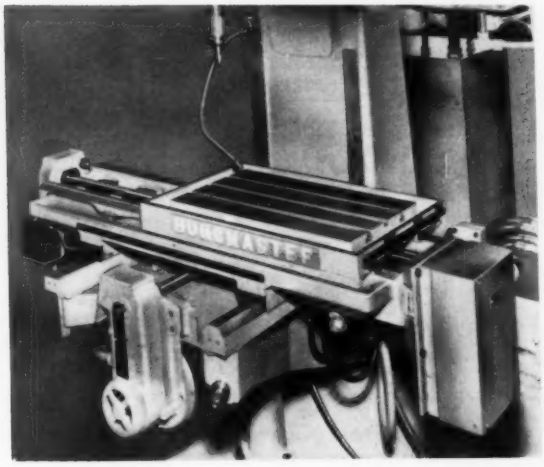


Fig. 3. Table and saddle of tape-controlled Burgmaster machine, Fig. 1, which ride on a combination of double-length vee and flat ways

the "A" location. Once this position is determined, all holes on the part are referenced to zero, and are so laid out on the programming sheet. Using the machine spindle-speed chart, the sequence of operations is laid out and the turret station requirements noted on the program sheet. One spindle may be used as many times as required before indexing to another tool or all operations may be completed for a particular hole location before moving the table.

When the hole coordinates, spindle sequences, and auxiliary functions are on the program sheet, Fig. 4, the programmer punches the tape, using a Flexowriter typewriter. Each dimension must be keyed with the correct letter as it is punched into the tape, i.e.: A 03156 B00400C1D. This is an example of tape punching for one coordinate hole location, correctly punched, for the starting position.

The balance of information covering a record of the part, operation sequences, tool sizes, feeds, speeds, and auxiliary functions are tabulated on the programming sheet. From this sheet a typist can readily prepare the punched tape on the Flexowriter typewriter.

The machine can be operated by any one of three methods: (1) manual control, (2) dial control, and (3) automatic tape control. The mode of operation is selected by a switch on the floor-mounted control station. Manual control is used for setting up or for individual operations when desired. With dial control the operator can set the dials to the digits that report a desired table dimension from the reference point for both the X and Y axes. Then, by pressing the cycle start-button the table and saddle automatically move to that position. This feature is desirable for making setups or for completing parts without a programming tape. When automatic operation is employed the console is set for this mode of control. The table and turret then carry through all operations on table location and spindle selection as punched in the tape in the order selected. The part is thus completely machined automatically.

Up to six operations for the 2BHT machine or eight for the 3BHT machine, as well as a stop command and other auxiliary functions, can be programmed for each X and Y position. When the stop command (for such auxiliary functions as inspection, tool change, unload, etc.) is executed by the machine, an indicator lamp lights up. There is no need for operator attendance of the machine once this mode of control has been initiated.

The standard adjustable Burgmaster machine controls are retained which provide pre-selective spindle speeds ranging from 20 to 3000 rpm. Turret faces can be skipped by setting standard buttons to provide a desired sequence of operations. Spindle feeds are infinitely variable and pre-selective for each individual spindle. A depth-control drum

BURGMASTER-G E PROGRAM SHEET PAGE _____ OF _____

FIRM _____ PART _____ DWG. No. _____

DEPT. _____ MAT. SPEC. _____

FIXTURE No. _____ BURGMASTER MODEL No. _____ 2BHT / 3BHT

TOOL CHART

TURRET POSITION	OPERATION	SPINDLE SPEED	FEED PER REV.
1	CENTER DRILL	3000	.004
2	39/64 DRILL THRU	700	.012
3	BORE .6250/.6250	450	.004
4	.043 DRILL THRU	12000	.001
5	11/16 DRILL THRU	350	.010
6	TOP 3/4-16 CLASS 3	225	.062

AUXILIARY FUNCTIONS: D - Coolant On E - Coolant Off M - Cycle Stop

COORDINATE DATA Strating Position: A _____ B _____ For Reference

	A - DIMENSION TABLE	B - DIMENSION Saddle	C - TURRET STATION	AUXILIARY FUNCTION
A	03.156	04.000	1	D-E
B	05.256	08.003	1	E
C	06.261	04.043	1	E

Fig. 4. Burgmaster-GE program sheet containing data from which typist prepares punched tape on Flexowriter typewriter

with micrometer adjustable stops provides depth control to ±0.002 inch and controls rapid approach to the work and return to eliminate lost time in a machining cycle.

The G-E automatic tape control is available for either the six- or eight-spindle Burgmaster turret drilling, tapping, and boring machines. These machines have 3/4-inch and 1 1/2-inch drilling and tapping capacity in steel and are available with standard table travels of 10 by 18 inches and 18 by 30 inches. Larger tables are available at extra costs.

Circle Item 565 on postcard, page 189

Niagara Redesigned and Expanded Line of Straight-Side Crank Presses

Extra rugged construction and exceptionally clean-cut styling are features of the redesigned and expanded line of straight-side single- and double-crank presses announced by the Niagara Machine & Tool Works, Buffalo, N. Y. This line includes non-geared, single-geared, or double-geared models, with either single- or twin-end drives in capacities ranging from 50 through 500 tons. Both standard and enclosed types of construction are available.

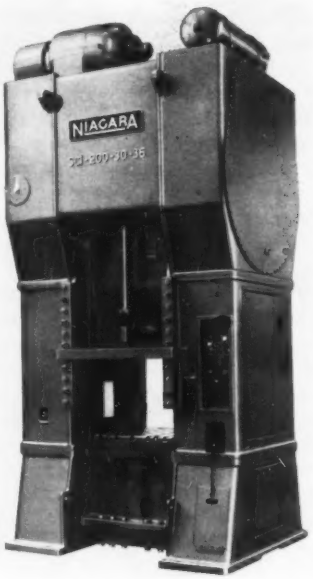
Standard presses have all-steel, rigid, one- and four-piece frames of patented, triple-box section design which provide maximum resistance to deflection. Box type, welded-steel slides are reinforced with heavy webbing. Shut height and slide adjustment permit use of an extensive range of stamping and forming dies. Long, adjustable gibs fully contain the slide during the working portion of the stroke. Laminated, non-metallic ways provide a positive safeguard against scoring.

The driving mechanism is entirely concealed, leaving no exposed or overhanging parts in the rear of the press. Flywheel, clutch and brake are housed in the crown. The independent, pneumatic friction clutch and brake provide the following combination of features which are said to assure trouble-free service: Low inertia—most of the clutch weight continues to rotate with the flywheel or gear; less heat—less wear; no bucking of clutch by the brake; no adjustments necessary; instant engagement and disengagement; easy accessibility; and quiet operation.

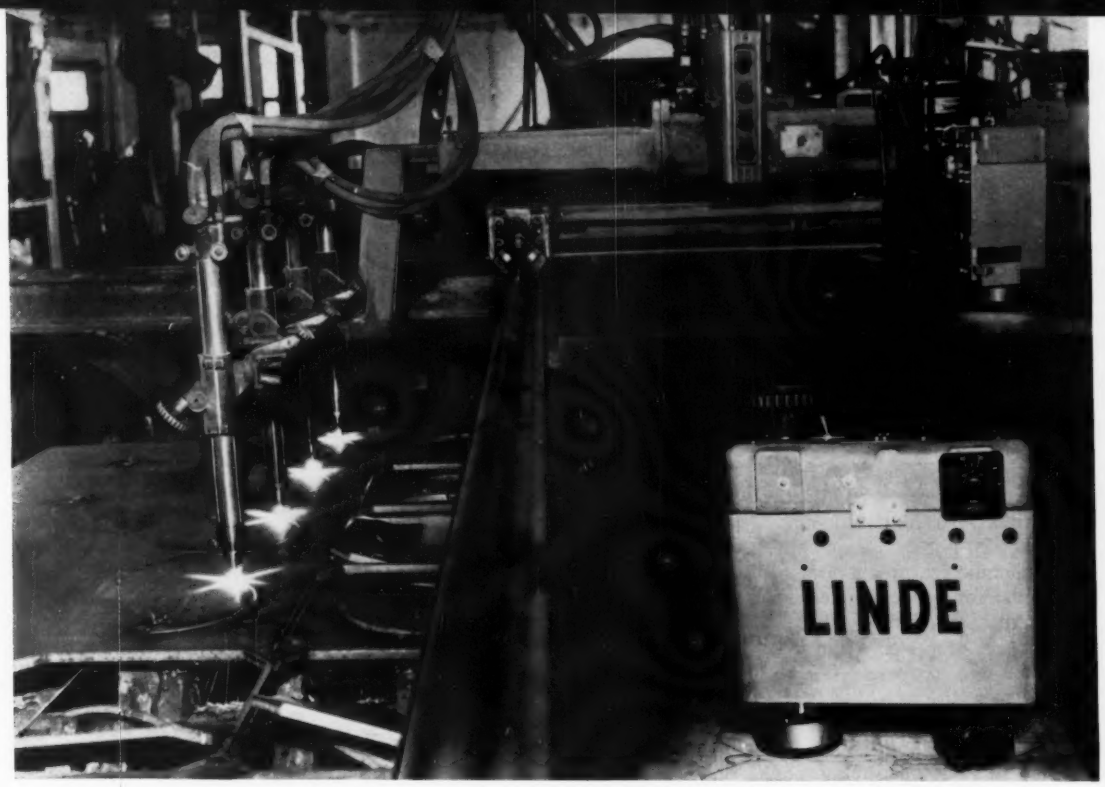
Centralized pressure lubrication sends oil to bearings, ways, and other parts. Steel gears run in totally enclosed oil baths. The operating control panel, integral with an oil and dust-tight enclosure containing all control devices, is conveniently mounted on the side of the press.

Streamlined and completely self-contained enclosed presses are built in capacities of 150 tons and larger. These presses incorporate all of the basic standard press features, plus advanced electrical and pneumatic controls, as well as automation devices as built-in components. Wiring, as well as air and oil lines, is completely concealed. A wide selection of special accessories, available for both standard and enclosed presses, includes die cushions; adjustable speed drives; automatic feeds; and automation controls.

Circle Item 566 on postcard, page 189



Straight-side crank press of redesigned and expanded line announced by Niagara Machine & Tool Works



Over-all view of electronic tracer in use on an Oxweld CM-15 flame-cutting machine and close-up of Linde Photocell Tracer unit (lower right corner)

Electronic Tracer for Flame-Cutting Machines Designed to Follow Pencil Lines

Simple pencil line sketches of intricate shapes and forms can now be used to guide oxygen shape-cutting machines. This is made possible by an electronic tracer introduced by the Linde Co., Division of Union Carbide Corporation, New York City. Easily prepared pencil or ink line drawings can be used with this tracer equipment to control single or multiple-torch flame-cutting machines. A built-in automatic kerf compensator makes it possible to reproduce one or thousands of complicated metal parts easily and with extreme accuracy from exact-size drawings. Automatic kerf adjustment represents a radical improvement in tracing units, permitting parts to be reproduced without the necessity of making allowance for kerf width on the drawing.

Known as the Linde Photocell Tracer, the unit, shown in the lower right corner of the illustration, eliminates the need for expensive metal or plastic templates, photographic negatives, or complicated and costly silhouettes. There is no need to make allowance for kerf width on the drawing which is made to the exact size of the part desired. The kerf compensator dial is then set for the plate thickness being cut and automatically compensates for kerf width so that reproduced parts are exactly the same size as the line drawing.

Preparation of the pencil or ink line drawings that guide the Linde Photocell Tracer is extremely simple. In most shops the savings in the elimination of conventional templates alone is said to pay for the new tracer in less than a year. The line drawings require little storage space and can be easily filed away in envelopes or drawers like letters.

Tracing accuracy is excellent. Intricate metal shapes and small holes that cannot be cut using present mechanical type tracing heads can be cut easily with the Linde tracer. It is not sensitive to extraneous light and will not follow shadows so that shape cutting can be done anywhere regardless of lighting conditions. Tracing speed is controlled by an efficient eddy-current governor which provides smooth, stepless speed control over a speed range that is adjustable from 2 to 30 inches per minute. At average cutting speeds, the tracer can negotiate 90-degree turns with a 1/16-inch radius.

With the tracer it is possible to use line drawings that will cause the cutting torches to move from one series of cut shapes to another, without interruption, for "chain" cutting. It is also possible to operate the new unit manually by using a steering knob conveniently located on the top of the tracer.

The heart of the Linde Photocell Tracer is a photoelectric scanning head geared to a steering motor which in turn is connected by means of a geared belt to the drive head. The main control box can be remotely mounted and is connected to the tracing head by a 25-foot multiple-conductor cable. A small remote control box that can be located to suit the operator's convenience either on the machine or on the tracing table is also provided.

Circle Item 567 on postcard, page 189

Sectionized Transfer-matic for Processing Hydraulic Steering-Gear Housings

The majority of the machining and inspection operations on a newly designed hydraulic steering-gear housing, Fig. 1, are performed in a "sectionized," pallet type Transfer-matic, Fig. 2, designed and built by The Cross Co., Detroit, Mich. Sixty-six operations are performed on each part as it passes through the fifty-five machine stations. The rated production capacity of this machine is 200 pieces per hour when operating at 100 per cent efficiency.

The machine features a new arrangement for pallet machines which permits portions of the machine to be stopped while the others continue to operate. To accomplish this, the machine is divided into three sections, and is arranged in a rectangular shape. The first section, occupying one long side of the rectangle, includes milling, drilling, reaming, spot-facing, trepanning, recessing, facing, probing, tapping, and rough- and semifinish-boring operations. The second and third sections occupy the other long side of the rectangle and are arranged to perform the precision finish-boring and air gaging operations respectively. Accumulating conveyors connect the three sections and independently feed each section on demand.

Another feature of the Transfer-matic is the unique way the precision boring operations are performed in the second section. In this section, the finish-boring of the two internal diameters at right angles to each other is performed with single-point tools. This requires a cycle time of 72 seconds. To balance the production of this section with the first and third sections, which have cycle times of 18 seconds, the boring is done on four parts at a time. The first four stations of the second section are makeup stations. These are filled one at a time from the accumulating conveyor. When all four are filled and when the boring operations are complete, the pallets are transferred in unison into the first boring station. Here the finish-boring of the first diameter is completed in four housings simultaneously. With the next transfer, the four pallets are transferred to an indexing station. Pallets are then indexed 90 degrees, two at a time, to avoid interference. With the next transfer movement, the four pallets are transferred to the next station for finish-boring the second internal diameter.

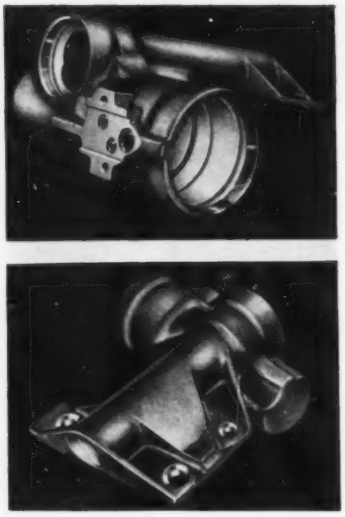


Fig. 1. Hydraulic steering-gear housing on which sixty-six operations are performed by machine seen in Fig. 2

Circle Item 568 on postcard, page 189

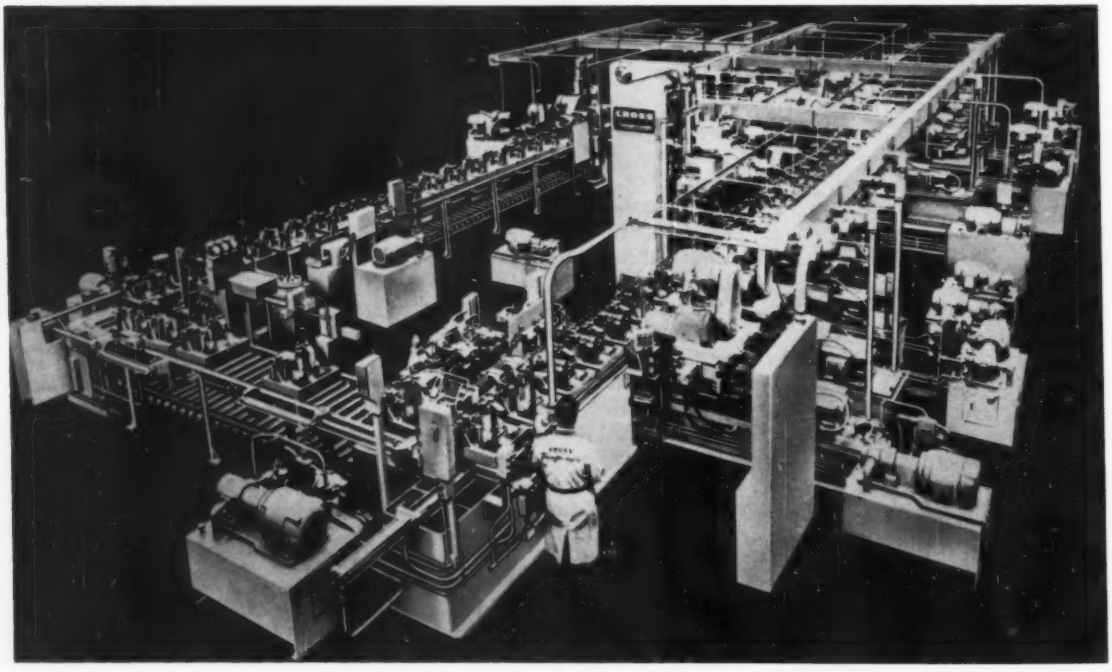


Fig. 2. Cross sectionized, pallet type Transfer-matic which performs the majority of the machining and inspecting operations on automotive part shown in Fig. 1, at the rate of 200 pieces per hour

Fig. 1. DoALL redesigned "Contour-matic" band machine

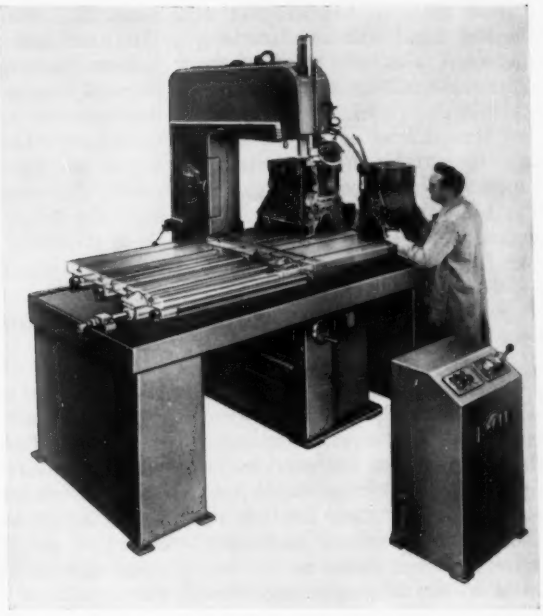


Fig. 2. DoALL extended-table model vertical band machine

DoALL Redesigned "Contour-matic" and Extended-Table Band Machines

The "Contour-matic" band machines, Models 16-3 (Fig. 1), 26-3, 36-3, and 60-3, now leaving the automotive type production line at the plant of the DoALL Co., Des Plaines, Ill., incorporate extensive changes and improvements over earlier models. These units are built to fully utilize the high cutting potential of the DoALL Demon high-speed steel saw bands for production work without in any way reducing their versatility for toolroom, model making, jobbing, and short-run production work. Cutting rates have been increased an average of 650 per cent. For instance, CR 1020 steel is cut at a rate of 10 square inches per minute.

The standard band-carrier wheels for all Contour-matic machines are of the ductile-iron flanged type with tapered, steel-backed rubber tires. For machines used exclusively for heavy-duty production work, an all-steel, flanged type wheel is also available. "Power-Cut" No. 360 coolant developed by DoALL for maximum cutting rates can be used with these wheels.

The saw guide assemblies do not require spacers or adjustment. Backup bearings and inserts support the cutting tool and both the backup bearing cap and the inserts are carbide-faced. The "Speedmaster" variable-speed unit uses all dynamically balanced, cast, and machined ductile-iron sheaves. Band-tension indicators are being added to all models as standard equipment.

Increased chip load resulting from the added sawing capacity is taken care of by a removable chip drawer. A quick disconnect coupling to the coolant system requires only a matter of seconds to remove the drawer and dispose of the screened and drained chips. Similar attention has been given to the convenience of the other machine functions.

The Model 26-3 Contour-matic band machine, Fig. 1, remains the all-purpose band machine with wide speed ranges, optimum power and rigidity, and the best work-size capacity (26 by 13 inches) for most users. The Model 16-3 is a smaller machine (16 by 8 1/2 inches) particularly useful for the smaller toolrooms and for light production. For users needing greater throat depth, DoALL offers the Model 36-3 (36 by 12 inches) or the Model 60-3 (60 by 13 inches) Contour-matic machines.

The extended travel work-table band machine, Fig. 2, just announced by DoALL is designed to facilitate handling large, awkward, band-machining operations. An extended-table model, designated by the suffix HB, is now available in each of this company's vertical band machines. The usefulness of long-travel tables has been shown by the success of the large, extra-heavy-duty band mill, Model 26-5.

The tables of the HB machines have an effective working stroke of 41 inches. They will move a 1-ton work-piece at any feed rate from 1.5 to 96 inches per minute. This permits every cut to be made at the best feed rate for the limitations of the material and the capacity of that particular machine. The eight split ball linear bearings of the 40- by 44-inch work-table roll smoothly on accurately aligned, hardened and ground rod-type ways. For positive, stepless control of feed rate the table is hydraulically powered. The maximum return feed rate is 144 inches per minute.

All of the HB model machines incorporate a unique feature first developed for the band mill. This

feature permits the changing of the saw band without disturbing the setup. The total travel of the work-table is 9 inches more than its effective working travel. At any time during a cut, the table may be withdrawn to its extreme position. This uncovers a gap in the table bed that allows easy access to the lower carrier wheel for band removal and replacement. The control console for the HB machines is on a separate pedestal that can be moved to the point of most convenience. There the operator can quickly move work to the blade and watch the action as the blade enters the work. The console contains not only the table controls but also all of the other machine controls.

Circle Item 569 on postcard, page 189

Moore Universal Measuring Machine with Motorized Lead-Screws

Motorized table positioning with accurate horizontal- and cross-feed lead-screws has been developed for its universal measuring machine by the Moore Special Tool Co., Inc., Bridgeport, Conn. The motorized lead-screw drive shown mounted on the machine in the accompanying illustration is offered as optional equipment. This equipment is designed to provide ultra-fine "missile era" precision measurement and exacting inspection standards. It is ideally suited for measuring large work-pieces to laboratory tolerances and is capable of measuring to one-third of one ten-thousandth of an inch.

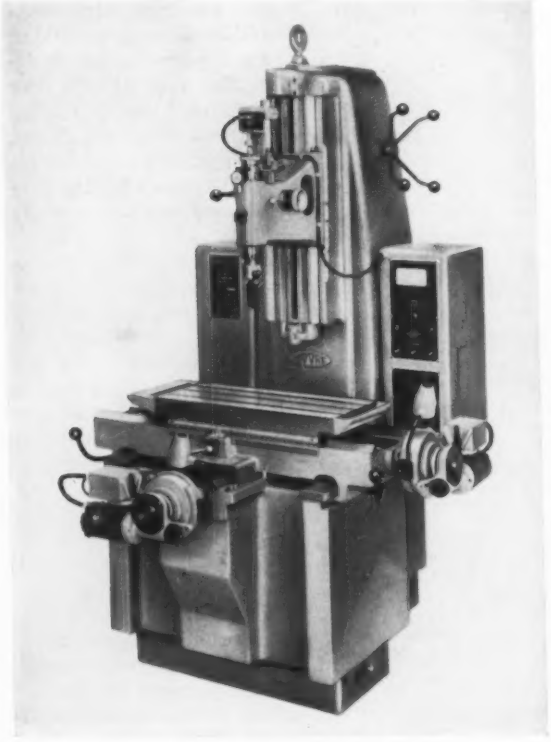
The measuring machine also offers a work capacity of 11 by 18 by 18 inches in height, and the choice of an electronic indicator supported on an accurate, rotatable spindle or a universal microscope for pickup. Provision is made for a combination of rectilinear and angular positioning, making possible the measurement of the most complex contours. The ways are hardened, ground and lapped steel, fitted to hand-scraped cast iron. Table positioning in two directions is by lead-screws.

When used in combination with the Moore ultra-precise rotary table, the universal measuring machine provides angular positioning accuracy compatible with the coordinate positioning accuracy of the machine table. The Moore Micro-Sine table extends this accuracy to compound angular settings. The maximum error in any inch of longitudinal travel is held to only 15 millionths of an inch and to only 35 millionths of an inch in 18 inches of travel. The spindle axis runs true within 3 millionths of an inch.

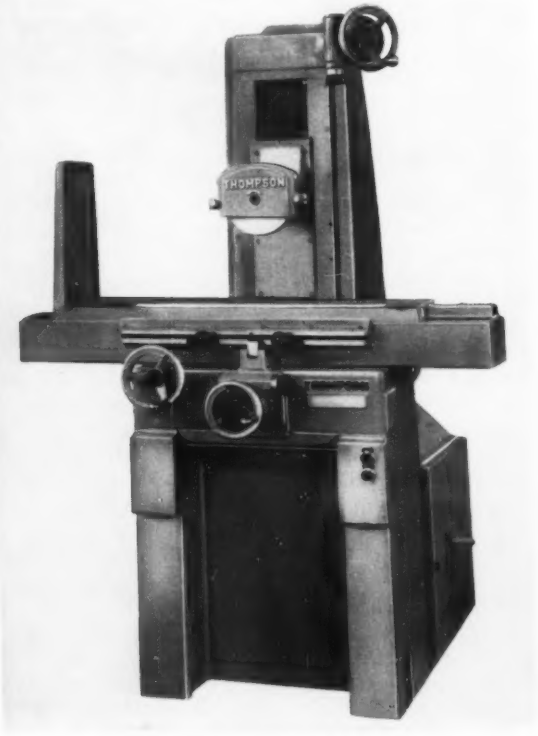
Circle Item 570 on postcard, page 189

Thompson Hand-Feed Surface Grinder

After thorough field testing, a Type D hand-feed surface grinder incorporating many new features is being offered for immediate delivery by the Thompson Grinder Co., Springfield, Ohio. Rugged-



Moore universal measuring machine



Thompson hand-feed surface grinder

ness and rigidity are combined in this machine with super-sensitivity and easy operation, to adapt it for general toolroom grinding. Special design features assure extremely close-tolerance work on carbide and other hard metals.

Vertical capacity has been increased to a standard 14 inches under a 7-inch wheel with no loss in capacity when using the wet attachment. Thus, the total work area of this unit is 6 inches wide by 14 inches high by 18 inches long. To assure closer tolerance work, the bearing quill is supported solidly through its entire length. The rigidity of the mounting of the various movable elements is increased by equipping all anti-friction slides with steel rollers which also eliminate all possibility of ball creep.

A 5-inch table movement per one turn of the handwheel serves to speed up the work and improve the quality of the finish-ground surface. No-backlash, anti-friction ball nuts and screws are features incorporated in the cross-feed to eliminate any possibility of the wheel creeping away from the work when shoulder-grinding. A new stop-dog arrangement, consisting of a casting anchored securely to the table, with a new swing-out type of stop for the table-dog contact, makes it possible to move quickly to a wheel dresser and to return to the initial stop position. The trim appearance of the machine is increased considerably by the use of metallic dials and knobs on all the feed-screws.

Circle Item 571 on postcard, page 189

Electrolytic Production Grinder for Carbide Tools

Development of a vertical-spindle electrolytic grinder capable of extremely high production with minimum wheel wear in the grinding of brazed type carbide tools is announced by the Mattison Machine Works, Rockford, Ill. This machine uses a 1500-ampere "Anocut" unit (the largest ever built) to supply the current required for the electrolytic grinding process.

Surface finishes up to 6 micro-inches are obtained while taking off up to 0.012 inch of tungsten carbide in a single pass on this Mattison grinder. Because there is no actual contact between the wheel and work-piece, wheel wear is said to be reduced as much as 90 per cent over conventional methods.

To permit maximum efficiency in loading and unloading the work, the rotary table is made with wedge-shaped magnetic sections that are energized individually just before the work-pieces go under the diamond wheel and deenergized immediately after pieces on the particular section leave the wheel. The work-table has a speed range of 1.7 to 12 revolutions per hour and the 25-hp spindle motor has a speed of 1800 rpm.

Special provisions are made to keep the electrolyte away from the brushes that carry electric current to the grinding wheel and to remove excess electrolyte vapors from the immediate area of the grinding wheel. A small blower moves air outward from the brush area and a mist collector gathers the vapors for condensing and draining back into the electrolyte storage tank. The capacity of the coolant system is 100 gallons. The coolant pump is 1/4 hp, has a speed of 1800 rpm, and can deliver 20 gallons of coolant per minute.

Protection for the grinding wheel is provided by a limit switch that stops rotation of the work-table if oversized stock is fed under the grinding wheel. The work-table is also stopped automatically if the electrolytic unit is cut out because of an overload. Machine can be provided with automatic sizing as optional equipment. The 100-grit, 100-concentration diamond wheel used by the machine is 16 inches in diameter, has a 4-inch face, and a diamond depth of 1/16 inch.

Circle Item 572 on postcard, page 189

Mattison electrolytic grinder for carbide tools

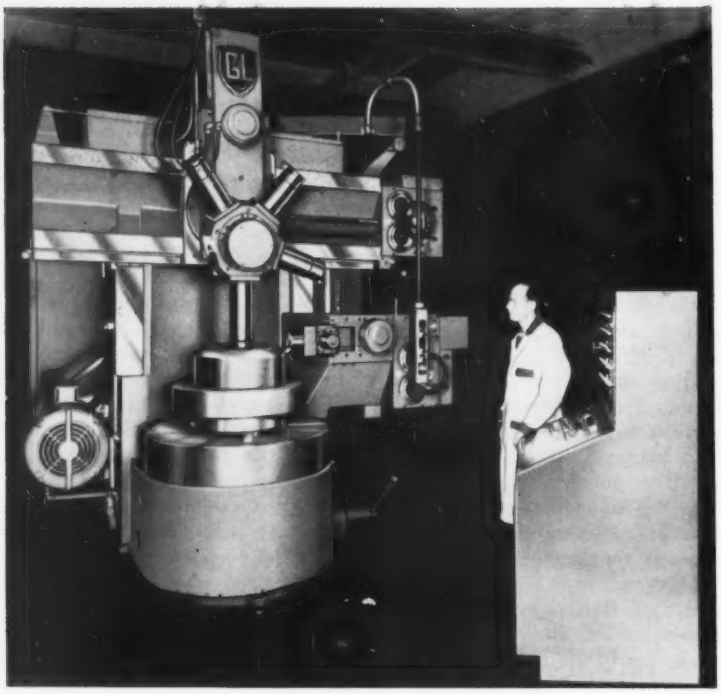


Fig. 1. Giddings & Lewis tape-controlled vertical turret lathe

Giddings & Lewis Tape-Controlled Vertical Turret Lathes

Vertical turret lathes built by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., are now being equipped with tape control perfected by its Kaukauna Division. The versatility and efficiency of this automatic control is said to make it economical and practical to employ these tape-controlled vertical turret lathes for short-run jobs, as well as for continuous production work. The turret lathe shown in Fig. 1, for example, is simple to set up and practical for short-run work. The easily programmed perforated tape system of this machine is adjustable to compensate for deflection or tool wear. The tape reader, Fig. 2, is on a sliding tray below the sloping control panel. The standard eight-channel reader is equipped with a rewind and take-up reel. Use of a loop storage box permits the tape program to be spliced into an endless belt and repeated over and over without reloading.

The flexibility of the adjustable coordinate system seen in Fig. 3 is enhanced by the fact that the feedback resolvers are connected to the lead-screws in the feed-box by spring-loaded serrated-face clutches. With this equipment the operator allows the machine to position automatically to a program location, then disengages the resolver unit for repositioning the machine as desired.

A typical manuscript form for the data from which the tape is punched on a standard electric perforating typewriter is shown in Fig. 4. Column entries indicated by *X* may be digits, letters, or both, depending on the codes established for table speed, feed direction, end position, feed rate, turret-index instruction, and position-adjusting potentiometer. The following is an explanation of the type of information used in each column:

Column 1, data for table speeds or special codes; columns 2 and 7, feed direction (one or two alphabetic characters); columns 3 and 8, end position to 0.001 inch; columns 4 and 9, feed rate; columns 5 and 10, turret-index instruction; and columns 6 and 11, designation of position-adjusting potentiometer.

The tape system exercises complete control over feeds, speeds, turret indexing, automatic dwell, and coolant supply, as well as all auxiliary functions the machine is capable of performing, such as constant cutting speed, thread cutting, drum scoring, cutting of tapers, and step turning.

A unique innovation, which greatly advances the practicality of numerical control for general shop use, is the override adjustment feature which enables the operator to add his information to the data system in the form of fine adjustments for either height or radius. These adjustments automatically become part of the program. They can be made during setup or actual operation to compensate for tool deflection or wear. This facilitates holding critical work-piece dimensions by adjusting the controlled position of the cutting tools over a range of plus or minus 0.010 inch.

Adjustments are made through a bank of fifty potentiometers in the operator's console, Fig. 2. Their use makes possible automatic machining to closer tolerance limits than normally would be expected from a skilled operator. But their real significance lies in the facts that setup time can be reduced by many hours; that tape can be used economically for any job that will be repeated, even once, at any future date.

Before the first completely automatic cycle is performed on a new part, the operator adjusts each head individually by cycling the machine in steps, or by operation, making the necessary "tuning" adjustments. Four special modes of operation are provided to facilitate and speed these procedures: (1) Single-head operation—one head functions normally under tape supervision while the other is turned off by means of a selector switch; (2) Single-cycle operation—the machine completes one line in the tape and then stops. The start button must be actuated for each new step. One or both heads may be operative; (3) Operation repeat—a given program step may be repeated any number of times, giving the operator a chance to check accuracy and make adjustments. He can assume

Fig. 2. Tape reader and control panel of turret lathe shown in Fig. 1

Fig. 3. Adjustable coordinate system mechanism of tape-control system

manual operation at any time, take a sample cut, and then push the "repeat" button for returning the machine to the point at which he took over. An accurate double-check on the amount of any correction can be made by reading the circular microdials on the feed-box. They give a direction indication to 0.001 inch of the original and corrected positions; (4) Manual operation—by turning the "manual-tape" selector switch, the operator can convert the machine to a conventionally controlled turret lathe and make test cuts for gaging.

After the setup has been completed for all heads, automatic operation can begin. The operator just turns the selector switch from "single-cycle" to "automatic."

Programming is simple and direct. Only a standard eight-channel Flexowriter typewriter is required to prepare a tape from the programmer's work sheet. An example of the manuscript format is shown in Fig. 4. Individual columns provide command data for table speeds, feed direction, end of position, feed rate, turret indexing, and override adjustments. Special codes are assigned for certain machine commands, and are entered in the form of numbers or letters. For example, "U," "D," "R," and "L" signify up, down, right, and left feed directions. Code "UR" means move up to the programmed position and move right at the same time. The resulting motion would be at 45 degrees. Similarly, turret-index directions are made by using the letters R and L, plus a digit signifying the desired turret position. For example, R4 means "index clockwise to No. 4 tool."

TABLE SPEED, SPECIAL CODES	DATA FOR RAIL HEAD					DATA FOR SIDE HEAD				
COL. 1	2	3	4	5	6	7	8	9	10	11
XX	XX	XX.XXX	XX	XX	XX	XX	XX.XXX	XX	XX	XX

Fig. 4. Typical manuscript form for data from which tape is punched for the tape reader shown in Fig. 2

Adjusting potentiometers have two digit codes which are entered in columns 6 and 11. Any potentiometer from No. 01 to No. 50 may be selected at any step in the program for either head. In establishing machine commands, the programmer must select the correct feeds, speeds, and tool paths. Critical work-piece dimensions must be assigned an adjusting potentiometer code so the operator's corrections will be made by the control circuit at the proper points in the cycle. The operator can observe each machine function from the console. After the first piece has been completed, the tape automatically selects the proper adjustment control and no further operator attention is required. Control devices are concentrated on the sloping panel, Fig. 2. Mounted on the top vertical panel are the fifty adjustment potentiometers with number indicator lights to show which controls are in use at any given time. To keep the operator informed of work status, a counter on the console indicates the last line that has been read on the tape.

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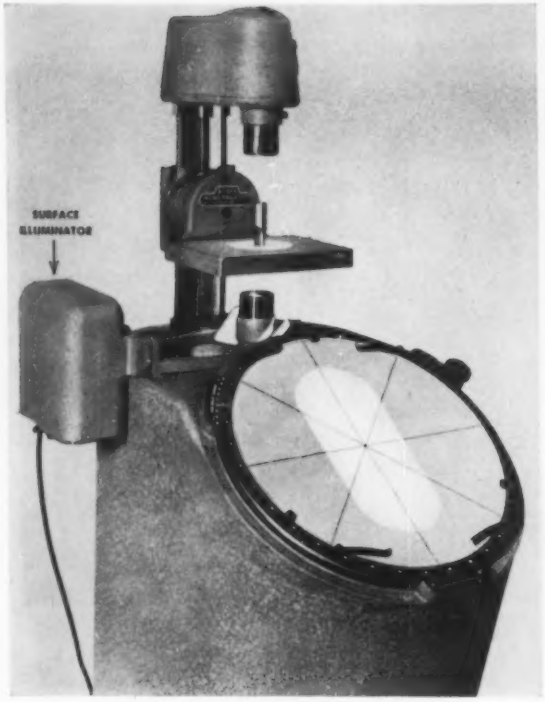


Scherr Micro-Projector equipped with surface illuminator

Hand-held Vibrograph announced by the Korfund Co., Inc.

Surface Illuminator for Scherr Micro-Projector

A surface illuminator which can be used for all standard magnifications, namely 10× to 100×, on their Micro-Projector, is being introduced by the George Scherr Co., New York City. This equipment, together with a complete line of optical industrial measuring instruments made by Carl Zeiss, Jena, will be on exhibit at the Western Metal Congress to be held this spring in Los Angeles.

The surface illuminator shown mounted on the Micro-Projector in the accompanying illustration incorporates some radically new features in its design. Wherever the design or contour of the work has to be picked up or viewed against an opaque background, such as the characters in numbering wheels or stamps, the design in punches, graduations on scales, dials or coins, surface characteristics, surface finishes, etc., projection in transmitted light by shadow image is not feasible. All such cases require projection by reflected light. The new surface illuminator uses a 500-watt standard projection bulb, no transformer being required. The result is an extremely distinct image. The mirrors are easily adjustable, permitting use of the unit for all magnifications from 10 to 100×, which rarely has been possible with other types of surface illuminators. Colors are faithfully reproduced on the image. This surface illuminator is a compact unit which readily fits any Scherr Micro-Projector without alteration or fastening device.

Circle Item 574 on postcard, page 189

Vibration Measuring and Recording Instrument

A highly accurate, mechanically operated, hand-held instrument which magnifies and permanently records frequency, amplitude, and wave form of vibrations and other mechanical motions has been announced by the Korfund Co., Inc., Long Island City, N. Y. Designated the Korfund Hand Vibrograph, this compact lightweight (less than 5 pounds) but ruggedly built instrument is available with both ink and 1-inch wide waxed-paper recording tape, and a tape take-up reel for convenient storing of readings. It has provision for varying the tape speed to simplify reading of high-frequency recordings.

This instrument simplifies machinery-maintenance scheduling since it provides a permanent record of the vibration amplitude at the time of installation. Comparison of the vibration readings on tapes taken at regular intervals with this original tape establishes the amount of wear in bearings or cutting tools, indicating when replacement will be necessary before breakdown. This permits maintenance operations to be placed on a scheduled, rather than an emergency basis.

The Vibrograph can also be used to measure revolutions per minute of rotating equipment where shafts or rotors are not readily accessible by simply placing its probe against the machine housing. In addition, it aids in balancing equipment, permits measurement of disturbance within a structure, and can be used as a read-out for differential analyzers having straight-line motion output. Other unique features include: variable magnification from 2 to 20 times; variable probe

tension to aid in maintaining probe contact with a minimum of force; and combination timer and event marker. The Korfund Hand Vibrograph is supplied in a mahogany carrying case 12 by 10 1/2 by 6 inches with the following standard accessories: tools, extension rod, roller contact, illuminated optical magnifier, spare parts, paper, ink, assorted pens and scribers, and full instructions. Optional accessories available include: reduction lever, stand, slow-motion clockwork, remote magnetic control, and pressure-gage attachments.

Circle Item 575 on postcard, page 189

Band-Sawing and Filing Machine

A 36-inch band-sawing, filing, and polishing machine has just been announced by the Enterprise Co., Columbiana, Ohio. This metal-cutting band saw is extremely rigid and is said to be vibration-free. It has a welded-steel frame, and a cast semi-steel, positive-locking tilting table. Its aluminum disc wheels have a low flywheel effect. The upper wheel moves on machined dovetailed ways. Upper wheel bearings are sealed for life and require no additional lubrication.

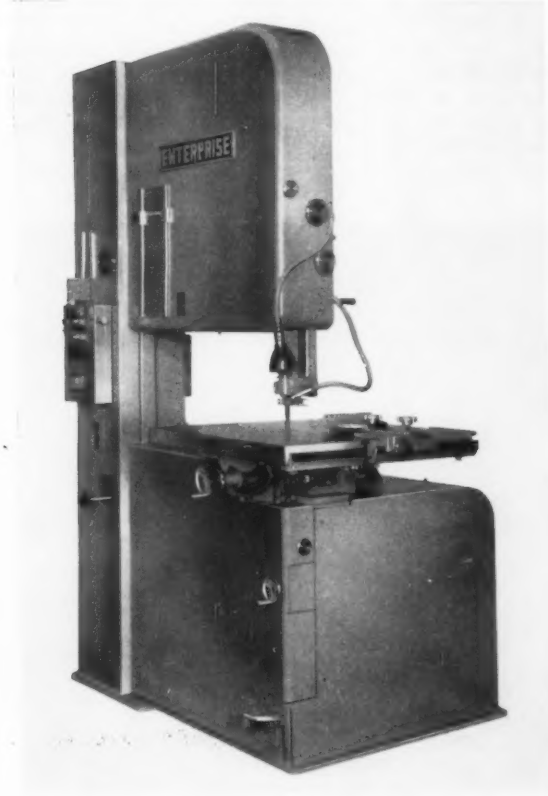
Other special features of the new machine are: a unique tool-selector for fifty-seven different materials; convenient controls located on the front of the machine; foot-controlled automatic feed; and a quick tension-release mechanism that automatically and immediately adjusts blade tension.

The variable-speed drive provides 35 to 6500 fpm (feet per minute) blade speeds, and may be optionally constructed to provide a speed range of up to 15,000 fpm. Its four-speed gear box is operated from a single control. NEMA wiring is furnished as standard. The machine has a built-in band welder with a capacity up to 3/4 inch, a grinder, and a shear. A built-in air blower keeps the work surface clear of chips, and a chip collector is furnished. Also supplied is a convenient, custom-built cabinet for the storage of all blades, attachments, and supplies.

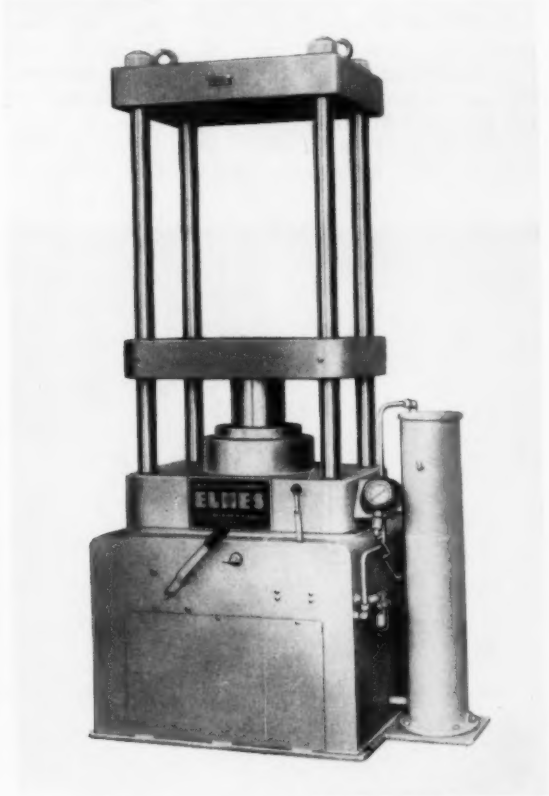
Circle Item 576 on postcard, page 189

Elmes "Hydrolair" Press for Molding, Compacting, and Assembling Operations

An air-powered hydraulic press called the Elmes "Hydrolair," designed for small-production work, testing, and research applications in the fields of plastics molding, laminating, compacting, assembling, etc., has been announced by the American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio. This unit is said to be very economical to operate, since it has neither motors nor



Enterprise band-sawing, filing, and polishing machine with tilting table



"Hydrolair" press introduced by American Steel Foundries, Elmes Engineering Division

pumps, taking its power right from the regular shop air line or from a small air compressor.

Standard model Hydrolairs are said to meet nearly all normal requirements. When the needs of a customer are very special, however, a custom-designed unit like the special type Hydrolair shown here is developed.

Where the ram on the standard Hydrolair is single-acting, the special unit is equipped with a double-acting ram to provide a "stripping" force which is necessary in certain molding applications that utilize multiple-cavity molds of more than average depth. Another modification of standard Hydrolair design is the length of the press columns, which have been made longer in order to provide a greater opening between the press platen and top head.

Also, this special unit is equipped with two Elmes "Power-Petuators" (Elmes-patented, air-hydraulic intensifiers), as required for the double-acting ram. This press is a manually operated type, with 125-ton pressure capacity and 15-ton stripping capacity, using air pressure ranging from approximately 70 to 90 psi.

Standard-model Hydrolairs are built in 30-, 50-, 75-, and 100-ton capacities equipped with manual control, available with or without hot plates. The standard 50-ton model is also available with electric push-button control. All models have rapid advance, providing efficient operation at normal shop air-line pressure. All controls, directional and pressure, are conveniently located at front of press. The hydraulic gage is marked in pounds and tons.

Circle Item 577 on postcard, page 189

Monarch Rotary Profile Tracer Lathe

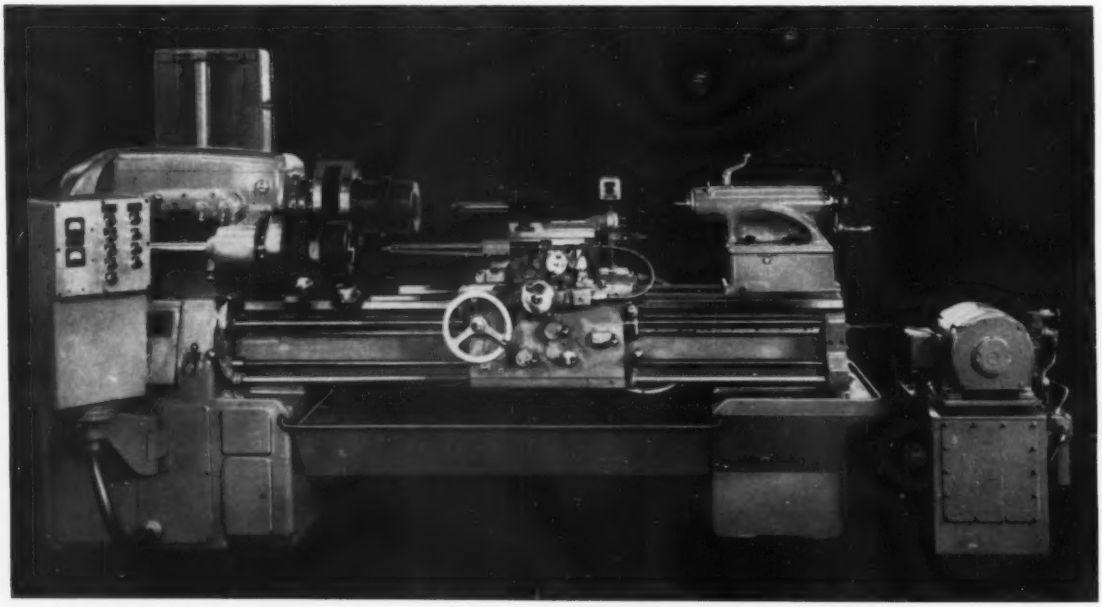
The boring of bottle molds having non-circular cross-sections is accomplished at exceptionally fast production rates and with improved accuracy on a rotary profile tracer lathe just announced by the Monarch Machine Tool Co., Sidney, Ohio. This machine will accommodate most bottle-mold work and it can readily be used for all conventional turning, boring, and threading operations. Its major feature is the Monarch super-sensitive electrohydraulic tracer. The head of the tracer is built into a bar that is adjustably mounted at the front of the cross-slide. The deflection pressure on the stylus is only 1 1/2 ounces. Electrical amplification of the stylus movement instantly translates the slightest work-contour change into hydraulic slide movement. Accuracy of reproduction is such that later hand-finishing operations require only a fraction of the time previously necessary.

At a feed of 100 inches per minute, accuracy of duplication of the tracer slide is ± 0.001 inch. The maximum tracer slide stroke at one setting is 4 inches. Tool is easily adjusted for diameter.

To facilitate setting-up operations the master spindle is located at the front of the machine. There is a positive gear drive from the headstock spindle through a quadrant-mounted idler which can be adjusted to remove all backlash between the lathe spindle and the master. A timing device on the master spindle is provided for angularly positioning the master mold and work-piece.

A female or a male master can be used. With the master spindle locked in a stationary position, a half-mold or a conventional flat template may be used to guide the tool for boring or turning. Because of the light stylus pressure, non-metallic materials may be used as masters.

Circle Item 578 on postcard, page 189



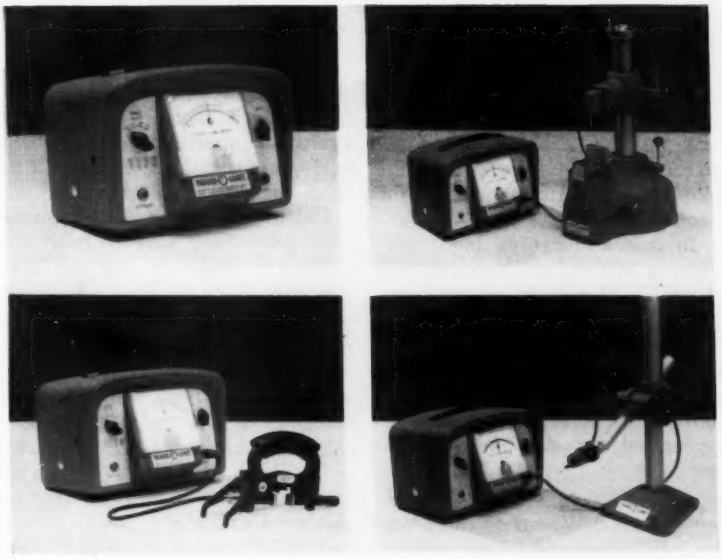
Rotary profile tracer lathe announced by the Monarch Machine Tool Co.

P&W Transistorized Gages

The Pratt & Whitney Co., Inc., West Hartford, Conn., has announced a line of measuring instruments, called Trans-O-Limit gages, that feature completely transistorized circuits and four separate magnifications. Any one of these four magnifications can be selected instantly by flicking a switch. Thus it is possible to measure optionally in thousandths, ten-thousandths, or millionths of an inch.

Trans-O-Limit gages are compact, light in weight and readily portable. They are designed to combine the ruggedness needed for shop and production-line use with the high accuracy and circuit stability needed for gage laboratory applications. Accuracy of readings is not affected by normal voltage and frequency fluctuations. Response is instant, with no time lag between gage contact and meter reading. The gaging circuit operates at 5000 cps (cycles per second) which permits greater miniaturization of several of the important components. As a result, gaging pressure is less than one ounce and will not distort extremely small and delicate work.

The Trans-O-Limit line consists of a cabinet containing the power unit and indicating meter, which can be used with the height gage, external comparators, snap gages, or the versatile cartridge units. All of these instruments are easily set up by using gage-blocks or other suitable masters. The indicating meter has a mirror-backed pointer which prevents errors in reading due to parallax and insures uniform readings by all operators.



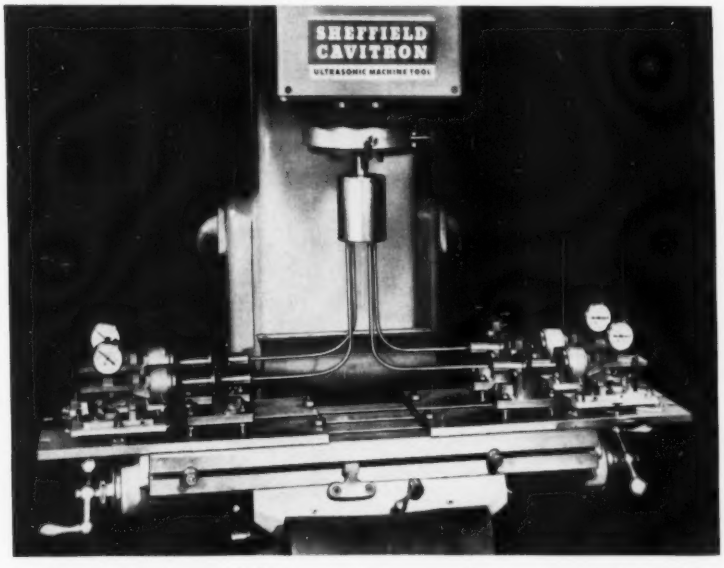
Pratt & Whitney Trans-O-Limit gaging equipment consisting of: (upper left) meter cabinet; (upper right) external comparator; (lower left) contact snap gage; and (lower right) height gage

Circle Item 579 on postcard, page 189

Sheffield Tooling Provides for Multiple-Station Ultrasonic Machining

A development in ultrasonic tooling that has increased the productivity of new and existing Sheffield-Cavitron ultrasonic machine tools as much as eightfold on some applications has been announced by the Sheffield Corporation, Dayton, Ohio, subsidiary of Bendix Aviation Corporation. In addition to being used to operate multiple machining stations from a single transducer as shown in the illustration, the tooling can be used also to "pipe" ultrasonic energy around corners, over long distances, and into previously considered inaccessible places.

Prior to this new development ultrasonic energy for machining hard, brittle metals and materials was transmitted to a single machining station located directly below the transducer by a combination tool-holder and tool less than 12 inches long. As a result, different operations on the same work-piece could be performed only by stopping the machine and changing the cutting tool or, in multiple machine installations, by progressing the part from one machine to the next.



Ultrasonic machine with four extension type tooling units mounted on table

The extension type tooling transmits the high-frequency mechanical oscillations from the transducer by means of curved cylindrical rods to remote machining stations located at any angle to the transducer. There is one rod or ultrasonic transmission line for each station.

In one application, eight machining stations are mounted on the table of a standard machine, permitting up to eight individual and different precision operations to be conducted on as many work-pieces simultaneously. Up to eight individual operations can also be performed on the same work-piece by progressing the part through each station. Stations can be operated simultaneously or independently.

Standard modular type tooling units for machining and dicing germanium, silicon, ceramic, ferrite, and similar materials are available. Each unit accommodates a cutting tool up to 1 1/2 inches in diameter and will machine work-pieces up to 2 inches in diameter. Each work-piece station has an independent feeding device. The depth of cut is indicated accurately in increments of 0.0001 inch.

Circle Item 580 on postcard, page 189

Large-Size Heat-Treating Furnace

The Surface Combustion Corporation, Toledo, Ohio, recently built the largest furnace ever shipped as a packaged unit. This furnace is designed to add flexibility to the heat-treating operations of a leading manufacturer of electric motors and controls. Its large oven surface serves to eliminate production problems, making it possible to perform many different heat-treating cycles and accommodate a great variety of part sizes.

The operating range of the furnace is 600 to 2000 degrees F. Large weldments, forgings, castings, and shafts 63 inches long can be handled in an upright position and are easily processed in this furnace, which has ample capacity for heat-treating work loads up to 7500 pounds.

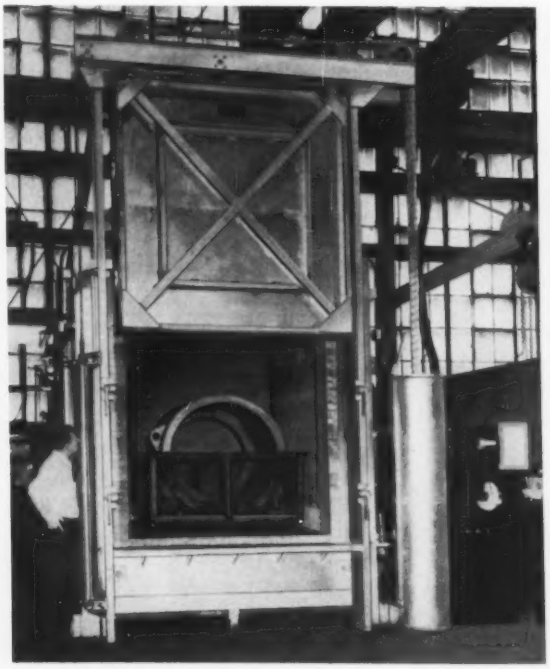
Circle Item 581 on postcard, page 189

Demand-Feed Storage Unit for Pipe Fittings

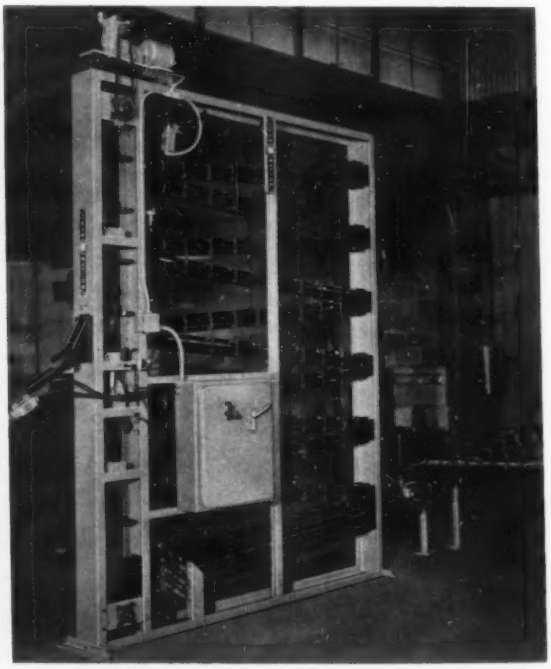
A high-capacity demand-feed storage unit for pipe fittings or any similar parts that can roll has been developed by Gear-O-Mation Division, Michigan Tool Co., Detroit, Mich. Designed for use in an automated processing line, the unit will handle three different sizes of pipe fittings, though not all at the same time. Only minor and easily made adjustments are necessary in changing over from one size or type of fitting to another.

The equipment consists of "zig-zag" gravity part-retaining tracks, fed from integrated parts elevators. The capacity of the unit shown ranges up to 1500 parts, varying with the part being run (the 4-inch pipe fittings are in outside diameter sizes of 1 5/8, 1 7/8, and 2 1/4 inches). The units insure production continuity of a line by providing parts storage combined with a true demand-feeding system. The unit requires a floor space only 1 foot by 6 feet. The total weight of the machine is about 2500 pounds.

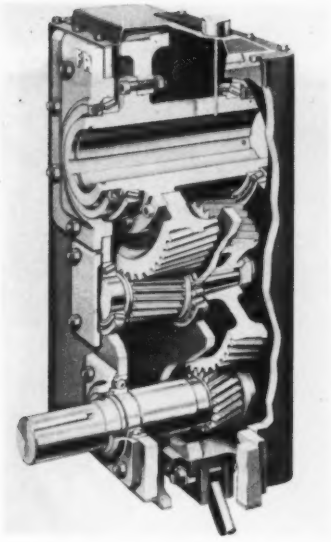
Circle Item 582 on postcard, page 189



Heat-treating furnace designed to handle large work built by the Surface Combustion Corporation



High-capacity demand-feed storage unit developed by Gear-O-Mation Division, Michigan Tool Co.



Shaft-mounted drive announced by the Falk Corporation

Falk Shaft-Mounted Drive

The Falk Corporation, Milwaukee, Wis., has announced the size 315GJ all-steel shaft-mounted drive, with increased torque rating of 41,000 pounds-inch at the low-speed shaft. With a ratio of 25 to 1, this unit covers a range of applications from 3 hp at 5 rpm to 30 hp at 50 rpm.

Features include: extra-depth, high-pressure-angle helical gears with 12 to 15 per cent greater load-carrying capacity and maximum mechanical efficiency than ordinary helical gears; all-steel, three-wall housing to maintain rigid alignment of revolving elements and to withstand external impact; inspection covers to facilitate checking gears and bearings; and dipstick for quick checking of oil level.

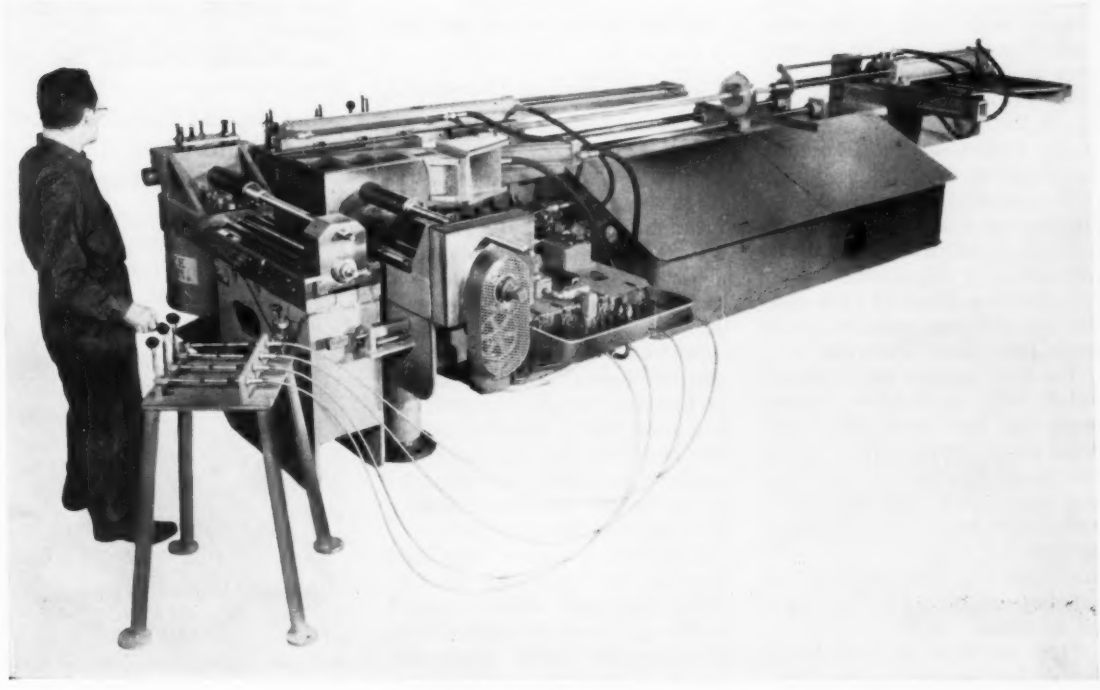
Circle Item 583 on postcard, page 189

Precision Tube Bender for Aircraft and Missile Work

The Wallace Supplies Mfg. Co., Chicago, Ill., is introducing a precision tube bender in its "Consensus" line. This machine is designed for bending thin-walled stainless and aluminum tubing. It will bend to a maximum angle of 180 degrees stainless-steel tube up to 5 inches in outside diameter with a wall thickness of 0.085 inch or aluminum tube up to 6 inches outside diameter with a wall thickness of 0.065 inch, depending on the alloy and yield point. The bending arm operates at a maximum speed of 2 1/2 rpm. A mandrel clearance of 12 feet 6 inches is standard. The radius is adjustable up to a maximum of 28 inches. Bending is controlled by the direct-action, remote-controlled hydraulic circuit. This allows the operator to control bending from a wide area.

Measuring devices are not needed to set up the machine. Micrometer positioning dials for the pressure die, clamping die, and shoe are of the built-in type. The bend angle is selected from the degree-graduated dial. Length gages are set from a length scale mounted on the machine. A protractor is built into the machine for rotation of planes between bends. There is an eight-station degree of bend selector for a series of bends on a single length of tubing. By having the bends needed on a length of tubing recorded on a process card the operator can set up the bender to exactly duplicate the original bends.

Circle Item 584 on postcard, page 189



Wallace precision tube-bending machine

"Hydromill" manufactured by Northern Illinois Machinists

Coolant-blender dispenser built by M. J. French Co., Inc.

Milling Machine with Hydraulic Feed

A "Hydromill" milling machine equipped with hydraulic feed, designed to give positive, foolproof operation, is being manufactured by Northern Illinois Machinists, McHenry, Ill. The hydraulic system is unique in that it has only three main parts which can be easily and quickly serviced. The feeds can be changed over in less than a minute. The table has a working surface of 8 by 25 inches, longitudinal travel of 12 inches, and a transverse travel of 8 inches.

The spindle is mounted in Timkin bearings and is equipped with a No. 40 standard taper. With the standard 1 1/2-hp motor which operates at a speed of 1140 rpm, the ten different spindle speeds range from 75 to 2700 rpm.

The feed may be set for right-to-left and rapid-return movements or for left-to-right and rapid return, or from right-to-left and stop, then left-to-right and stop for use with two fixtures. The feed ranges from 0 to 600 inches per minute. Since it is hydraulically operated, there are no micro switches or solenoid valves to get out of order.

This machine is completely flexible for different combinations of feeds, including hand-lever feeds in three directions, micrometer lead-screw feeds in three directions, or with provisions for using both hand-lever and micrometer lead-screw feeds in three directions. The "Hydromill" will take a 7-inch diameter cutter under the over-arm.

Circle Item 585 on postcard, page 189

Portable Coolant Dispenser

A portable coolant blender, capable of dispensing varying mixes of water-soluble coolants at the machine is being built and marketed by the M. J. French Co., Inc., Rochester, N. Y. Designed as a one-man unit, this blender employs two positive displacement pumps linked to metering valves to allow the selection of an infinite number of coolant mixes in proportions ranging between 10-to-1 and 100-to-1. One simple control handle varies the mix from machine to machine as required to give exactly the correct mixture for each operation.

A 75-gallon water tank and 5-gallon oil container on the unit is generally sufficient to fill a line of machines without replenishing the supply. A gasoline service-station type dispensing hose with trigger valve at the outer end aids easy filling of the machine sump tanks at the rate of 10 gallons per minute. The unit is accurate in its oil-water ratio regardless of electrical or ambient temperature fluctuations.

The blending portion of this unit can be supplied for permanent installations on central systems without the tank and wheel assembly.

Circle Item 586 on postcard, page 189

Machine-Cut Stainless-Steel Rings and Discs Made to Reduce Production Costs

Users of stainless-steel rings and discs may now secure these products machine-cut to size from Joseph T. Ryerson & Son, Inc.,

Stainless-steel rings and discs made by Joseph T. Ryerson & Son, Inc.

Chicago, Ill. These rings and discs have tolerances which are close enough and edges that are smooth enough for many applications without the need for further processing. According to the manufacturer, who supplies both flame-cut and machine-cut stainless-steel rings and discs, there are times when users may save money by ordering these products machine-cut to size instead of buying them oversize and then machining them to the required size and edge smoothness.

The machine-cut stainless rings and discs are normally held to size within plus or minus 1/32 inch although cutting can be done to much closer tolerances when required. The edges are smooth and the normal flatness of the plate material is retained. The corrosion-resisting qualities of the material are undisturbed, and for many purposes, the material is ready to use without further machining.

Rings and discs in Types 304 and 316 stainless steels and in the extra-low carbon analyses Types 304L and 316L are in greatest demand. Rings and discs can also be furnished in other stainless-steel alloys.

Circle Item 587 on postcard, page 189

Feed-Rate Indicator

A feed-rate indicator powered by 110-volt A.C. is now available from the National Automatic Tool Co., Inc., Richmond, Ind. This compact, portable device makes it easy to gage forward and reverse feed rates of machine tool components. It has a range of 0 to 50 inches per minute over 4 inches of travel.

The indicator consists of a pick-up component and a control component, both housed for carrying in a single 9 1/2- by 6 1/2- by 4 1/2-inch case. For checking feed rates, the pick-up is mounted on a machine way or slide by permanent magnets in its base, and the feed rate is read directly from a dial on the control component, which is light enough to be held in the hand. This A.C. feed-rate indicator is similar in application and appearance to a previously announced battery-powered model.

Circle Item 588 on postcard, page 189

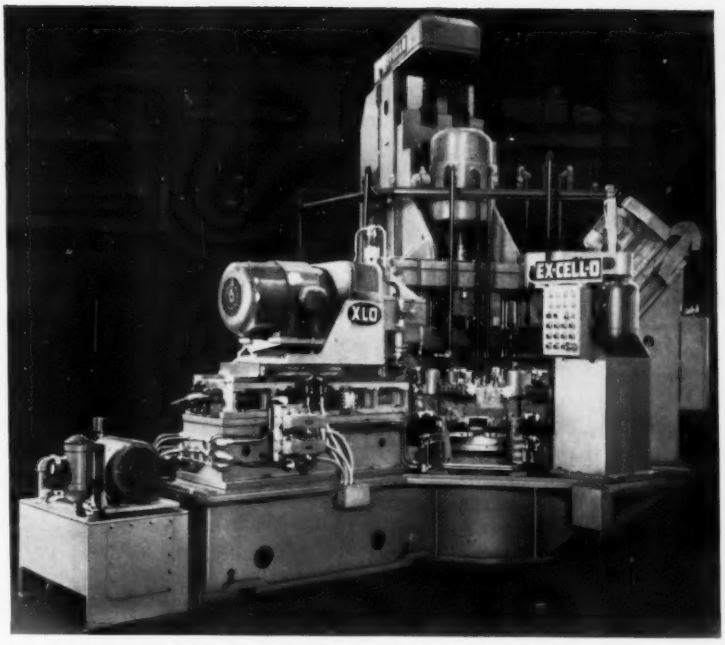


Fig. 1. Ex-Cell-O eight-station index machine equipped to process part shown in Fig. 2

Eight-Station Rotary Index Machine for Processing Oil-Pump Bodies

The Ex-Cell-O Corporation, Detroit, Mich., has announced a custom-built, eight-station rotary index machine which processes sixty-eight oil-pump bodies per hour. This machine, Fig. 1, processes both sides of the pump body, Fig. 2, including spot-facing, milling, drilling, tapping, reaming, and core-drilling. The material is gray iron and must be held to close limits on both roughing and finishing operations.

The machine table is arranged with a set of eight, two-position work-holding fixtures. Each side of the fixture is equipped with an individual set of hydraulically operated, cam-locked clamping members and manually actuated backup jacks to rigidly hold and support the part. In order to perform the operations required on each side of the work-piece, it is initially mounted in the left-hand side of a fixture and cycled through the machine. Upon returning to the first station, the part is re-loaded in the right-hand side of the fixture and re-cycled through the machine.

The machine base and columns are of welded-steel construction. A shot pin locates the indexing work-table. The first station is, of course, reserved for loading and re-loading. A horizontally mounted slide for milling the flat surfaces of the part is located at the second station. A vertically mounted drill head and bushing plate assembly performs a series of drilling and reaming operations at the third, fourth, fifth, and sixth stations. An angularly positioned unit is utilized to bore the cored hole at the seventh station and a vertically mounted head carries the taps at the eighth station.

Circle Item 589 on postcard, page 189

Fig. 2. Cast-iron oil-pump body processed on machine illustrated in Fig. 1

Torch for Manual "Sigma" Welding

The Linde Co., Division of Union Carbide Corporation, New York City, has announced a consumable-electrode, inert-gas metal-arc welding torch called the "Sigmette." The wire spool mounted on the torch permits the operator to get at jobs in confined spaces and areas remote from power and gas supply lines. Thus the moving of heavy equipment is eliminated.

The "Sigmette" torch weighs 3 pounds and the control box weighs less than 20 pounds. Rated at 200 amperes, the torch will handle the full welding range with 3/64-inch aluminum wire; applications on aluminum 0.093 to 1/8 inch thick using 0.030-inch wire up to 125 amperes; limited applications with 1/16-inch aluminum wire; and 0.030-inch carbon steel wire. Torches are available for the full welding range with either 0.030- or 1/16-inch aluminum wire.

The "Sigmette" torch is easy to maintain, an ordinary screwdriver being the only tool necessary. Internal parts, including the electric wire feed motor in the handle, are easily accessible. Of special interest is the high safety factor: the torch and component control are completely insulated—the operator is protected from contact with electrically charged or "hot" parts.

Circle Item 590 on postcard, page 189

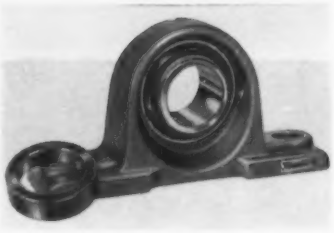


Fig. 1. Fafnir ball-bearing pillow block

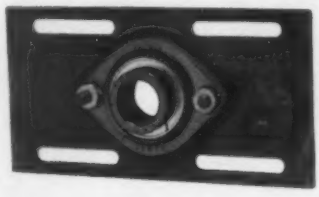


Fig. 2. Ball-bearing take-up unit

Fafnir Ball-Bearing Pillow Blocks and Take-Up Unit

Two series of relubricatable ball-bearing pillow blocks featuring improved seals, a redesigned housing, and lower prices are being introduced by the Fafnir Bearing Co., New Britain, Conn. These units are designated the LSA or standard series and the LSAO or heavy-duty series. Both lines incorporate integral seal bearings. The newly designed housing, Fig. 1, combines greater strength with an over-all streamlined appearance. Both units will have the same base-to-center height dimension and bolt-hole spacing as the company's existing SA and SAO lines, respectively. The LSA series will be offered in sizes up to 2 15/16 inches and the LSAO up to 3 15/16 inches.

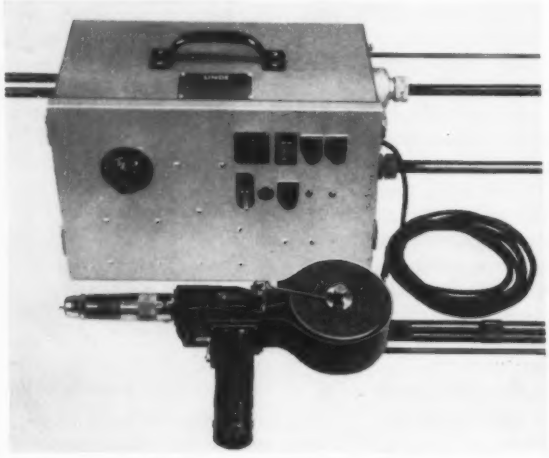
Fig. 2 shows a ball-bearing, pressed steel take-up unit, another recent development of the Fafnir Bearing Co. This rugged, compact unit is said to offer substantial savings to many manufacturers who have been making their own take-up units.

The unit is available in two basic sizes covering eight different shaft dimensions. It can be mounted by using either guide type or bolt type methods and can accommodate misalignment without adjustment. The "built-in" self-alignment of the Fafnir ball bearing will offset differences in take-up on either side of the shaft. Sealed and permanently prelubricated, this bearing is equipped with the Fafnir-originated self-locking collar designed to reduce installation to a simple twist-of-the-wrist motion. No machining of shaft shoulders is required and no mounting devices are needed.

Circle Item 591 on postcard, page 189

Hydraulically Operated Squaring Shears

The Wysong & Miles Co., Greensboro, N. C., has announced the addition of hydraulically operated squaring shears to their



Linde Sigmette welding torch

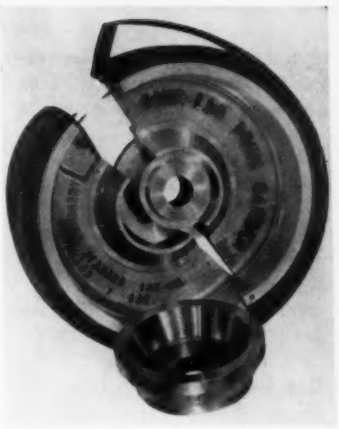
Wysong hydraulically operated shears

line of motor-driven air- and foot-powered shears. Adjustments, which can be made in one minute, control the accuracy and the quality of the cut of any shearable material, including metals, plastics, and composition sheets of various kinds.

The speed of the ram is adjusted by turning a small knob to open or close a flow control valve. The length of the cut for full-length shearing or for notching can be varied by a limit switch. Hold-down pressure can be varied by simply opening or closing a valve. The slope of the top blade can be varied from zero to 3/8 inch per foot. Push-button control enables the operator to raise the hold-down for easy access to the top blade bolts.

Overloading stalls the machine without damage to parts. Operation is quiet and smooth. The Model HS-1052 machine illustrated has a cutting length of 52 inches and a rated capacity of 10-gage mild steel. Other models are available with cutting lengths of 6 feet, 8 feet, and 10 feet.

Circle Item 592 on postcard, page 189



Cone-Loc drum sander announced by American Diamond Saw Co.

"Pedrimatic" Automatic Bending Machine

An automatic bending machine that does not require an operator has just been announced by the Pedrick Tool & Machine Co., Philadelphia, Pa. The "Pedrimatic," as it is called, is of the machine-loaded type and has a 10-groove die. It is end-loaded by an air or hydraulic cylinder. The entrance of the new, straight piece ejects the preceding piece which has been bent. It is just as feasible to load ten pieces that have been stacked in a conveyor as it is to load one.

The "Pedrimatic" is said to be the first rotary-head automatic bending machine to be produced. Unlike any other type of automatic bending, this method combines speed with no tangent limitations. If desired, "Pedrimatic" can be made to produce U-bends whose tangents are 6 feet long.

Circle Item 593 on postcard, page 189

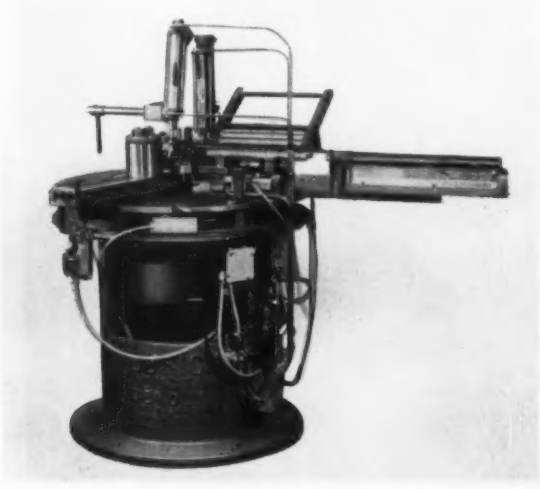
Cone-Loc Drum Sander for Shaping High-Speed Tool Bits

A method for shaping high-speed tool bits has been announced by the American Diamond Saw Co., Portland, Ore. Strips of coated abrasives, combined with the cushioning action of this company's "Cone-Loc" drum sander are said to greatly reduce heating and to remove material much faster than it can be removed by a hard grinding wheel. The manufacturer is now shaping all his tool bits with a Cone-Loc drum sander of the type shown in the illustration, leaving only the sharp finishing operation for the hard grinding wheel.

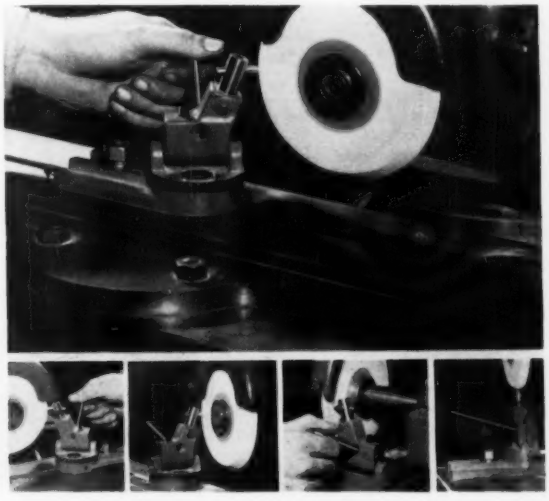
Circle Item 594 on postcard, page 189

Angle Dresser for Tool- and Cutter-Grinding Wheels

The Steptool Corporation, Los Angeles, Calif., has developed an angle dresser for wheels used in grinding tools and cutters, as well as for dressing the wheels used in cylindrical and surface grinding. The dressing action of this device is obtained by rocking be-



Automatic bending machine announced by the Pedrick Tool & Machine Co.



Steptool angle dresser developed for tool- and cutter-grinding wheels

tween centers. The centers are designed to exclude dust, and have a take-up that can be adjusted to obtain a snug fit. This eliminates chattering and results in a fine microfinish.

The small and handy dresser can be left on the machine since it pivots on hinges down out of the way to prevent collision with the grinding wheel. It is safe, because the operator's hands never get near the grinding wheel. The dresser has a graduated base which can be locked in a fixed position for dressing horizontally or under the wheel with the slide movements of the machine itself. A sturdy post carrying the diamond nib swivels the point in any direction. It can be raised or lowered to match the center heights of any make of grinder, and to permit grinding or sharpening above center while the diamond actually dresses the wheel at the center position. The dresser also lends itself to cam-roller grinding techniques, and can dress an arc in the wheel for radial relief sharpening.

Circle Item 595 on postcard, page 189

Automatic Vertical Balancing Machines

A series of completely automatic Schenck vertical balancing machines for either one- or two-plane balancing (static or dynamic) is now available from the Cosa Corporation, New York City. This equipment is made in five standard sizes with weight capacities from 0.5 to 1100 pounds. They are especially suited for balancing disc-shaped parts such as flywheels, fans, etc.

On all Schenck vertical models the work-piece holder (arbor or faceplate) is integral with the balancing spindle and can be provided with a quick-clamping device. Once the rotor is set up and the starting button pushed, the machine runs automatically up to full speed. The amount and location of the unbalance is shown by a light spot on the instrument screen and the machine is electrically stopped. The complete cycle takes but 10 to 20 seconds.

The angular position of the light spot on the instrument screen represents the unbalanced location in the work-piece—referred to by a protractor dial mounted on the balancing spindle. The distance of the light spot from the center of the instrument screen is a measurement of the amount of unbalance. This radial deflection can be easily calibrated for setting a convenient correction unit by merely turning a potentiometer control.

Standard, interchangeable-component screens are available for work-pieces that can be corrected only in certain circumference sections (e.g. multiple-blade fans) to eliminate split-up difficulties and correction inaccuracies. Correction units for drilling, milling, etc., can also be added to the machine.

Circle Item 596 on postcard, page 189

Comparator Head for Ames Porta-Check Comparator

A comparator head, designated Model No. AE-22, has been developed by B. C. Ames Co., Waltham, Mass., for use with its

Schenck vertical balancing machine introduced by the Cosa Corporation

Ames Porta-Check comparator equipped with newly developed comparator head

recently introduced Porta-Check portable transistorized comparator. This head has a measuring range of 0.006 inch on the thousandths scale and 0.0006 inch on the tenths of a thousandth inch scale. Spindle travel to the zero position is 0.030 inch and it has a gaging force of 4 ounces.

When used with the Porta-Check, this small but rugged comparator reads to 0.00001 inch. It is fitted with a removable contact point 1/4 inch long and a 4-foot cable with a connector for plugging into the Porta-Check.

Circle Item 597 on postcard, page 189

Starrett Dial Bore Gage for Measuring and Inspecting Cylindrical Bores

A No. 84 Series dial bore gage designed for inspection as well as checking hole sizes during machining or grinding operations has been brought out by the L. S. Starrett Co., Athol, Mass. These gages will measure bore diameter in ten-thousandths or half-thousandths of an inch, depending on the model chosen. They will also indicate variations from true bore such as taper, out-of-round, bellmouth, hour glass, or barrel shape. The gage is made in three sizes to cover a range of 3 to 12 1/8 inches and is available in six models to provide a choice of indicator readings in 0.0001 or 0.0005 inch.

The handle, indicator housing, and gaging head are made of aluminum for light weight and easy handling. The capacity for covering a wide measuring range is made possible by an adjustable and interchangeable, positive-locking screw. The gage is self-centered in the bore by two spring-loaded centralizing plungers and the range screw which provides three-point wall contact. Separate spring-loaded gaging contact gives accurate, reliable, repetitive readings. Gaging contact, centralizing plungers, and range extension screws are normally hardened and tempered tool steel but carbide tips are available on special order.

Circle Item 598 on postcard, page 189

Dial bore gage made by the L. S. Starrett Co.

Cimperial Water-Soluble Cutting Fluid

An economical water-miscible cutting fluid, especially designed for use on heavy-duty, low-clearance, low-speed operations previously limited to cutting oils, has been developed by the Cincinnati Milling Products Division, Cincinnati, Ohio. This Cimcool Cimperial concentrate chemical solution is said to be adapted for use on 95 per cent of all metal-cutting jobs. Mixed with water at dilutions ranging from 1 to 5 up to 1 to 15, it can replace cutting oils on heavy-duty machining work. At dilutions from 1 to 20 up to 1 to 60 it can also be used for standard milling and grinding operations.

Application of Cimcool Cimperial water-soluble cutting fluid to broaching operations

Tool life and cutting efficiency are increased by the chemical lubricity of Cimperial. Its extreme pressure additives serve to reduce the heat of metal cutting and permit faster feeds and speeds. The effective bactericides in Cimperial are claimed to provide a lasting immunity to rancidity. This fluid contains no food for bacteria and actually prevents bacterial growth in machine tool reservoirs.

The bactericide in the fluid is perfectly safe but sufficiently strong to kill any bacteria which might produce rancidity. Cimcool Cimperial also has exceptional rust-control qualities even in lean dilutions. Two independent rust inhibitors prevent the electrochemical process of rusting, and counteract corrosion on all metals. They form protective films which cover and bond themselves to the surface of all the metals with which the cutting fluid makes contact.

Circle Item 599 on postcard, page 189

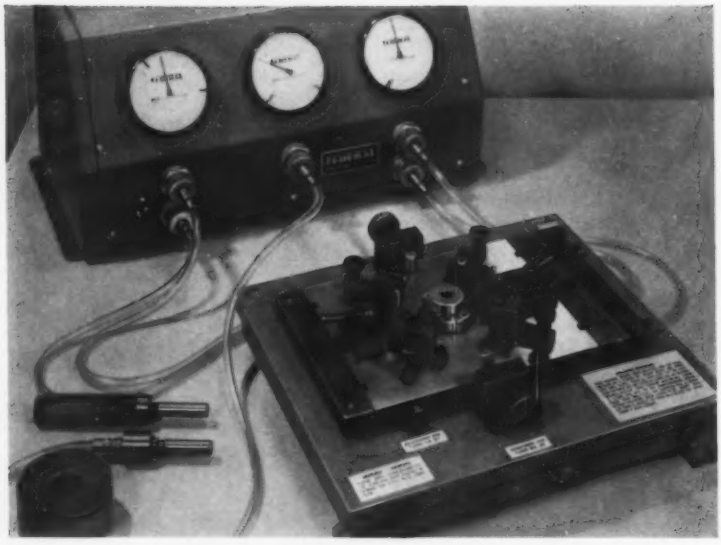


Fig. 1. Federal triple-unit Dimensionair gage and fixture used for accurate assembly of parts shown in Diagram C, Fig. 2

Gage Designed to Assure Accurate Assembly

The precise positioning of parts to permit extremely accurate assembly of the end plates and cylinder of a guided-missile-flight control actuator (Diagram C, Fig. 2) is accomplished with a triple unit Dimensionair air gage and a specially designed fixture shown in Fig. 1, made by the Federal Products Corporation, Providence, R. I. This instrument permits the end plates to be positioned so that the vaned rotor will maintain 0.0003 inch (± 0.0001 inch) clearance with the cylinder wall throughout 150 degrees arc of travel (see Diagram A, Fig. 2).

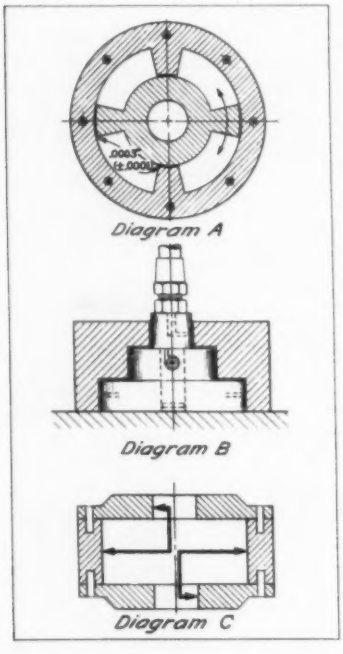


Fig. 2. Diagrams illustrating application of gaging equipment shown in Fig. 1 to precision assembly of parts shown in Diagram C

The gage is first set up by placing a stepped master setting ring on a dual air plug located on the fixture (Diagram B, Fig. 2). A portable single-jet air plug is then inserted in the master ring and fine adjustment screws are used to move the reference plate until the master is centered in two planes. The final position is achieved when the center air-gage meter reads zero in each of four positions located 90 degrees apart. Adjustable dials on the outer meters (connected to the fixed dual air plug) are then zeroed.

After the master ring is removed, the work-piece cylinder is placed on the fixed air plug and its position adjusted so that both outer dials again show a zero reading. An end plate is then placed on the cylinder and roughly positioned by inserting a fixed taper plug. After removing the fixed plug, the portable, single-jet air plug is placed in the hole to sweep the bearing diameter of the end plate. Radically located fine-adjustment screws are used to position the reference plate until the sweep of the air plug causes no perceptible variation of the hand on the center air-gage dial. Bolts are then inserted and tightened so the assembly can be removed and holes drilled for locating pins.

Circle Item 600 on postcard, page 189

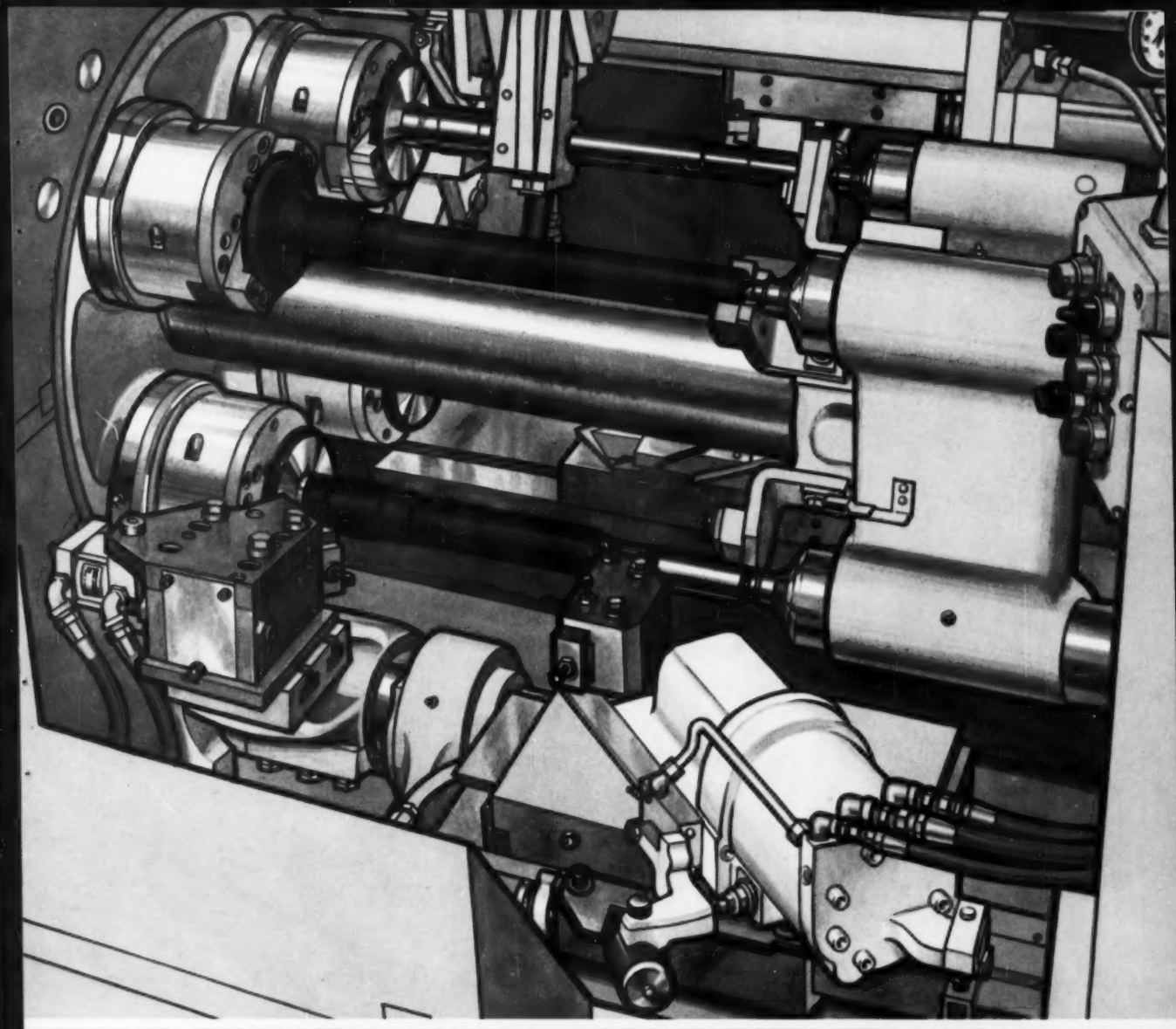
Portable Drilling Equipment

A portable power tool designed to drill, countersink, or counterbore holes in a single operation to the close tolerances usually obtained by reaming is being made by the Winslow Product Engineering Corporation, Arcadia, Calif. This tool, called the Winslow Spacematic drill motor, eliminates the need for jigs and fixtures.

High-speed steel drill used in portable tool made by Winslow Product Engineering Corporation

The multiple-purpose drill illustrated, which is used in the portable tool, is specially heat-treated and sharpened for a specified operation. It is made of Allegheny Ludlum Steel Corporation's alloy DBL-2, a high-speed steel. This steel, containing tungsten, molybdenum, and vanadium, is of a fine grain structure. The Winslow Spacematic can drill and countersink a 3/4-inch deep hole in airframe materials in five seconds.

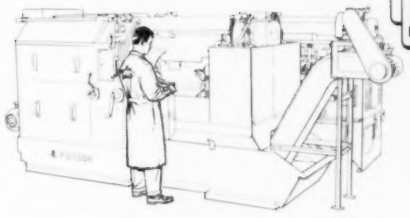
Circle Item 601 on postcard, page 189
(*This section continued on page 182*)



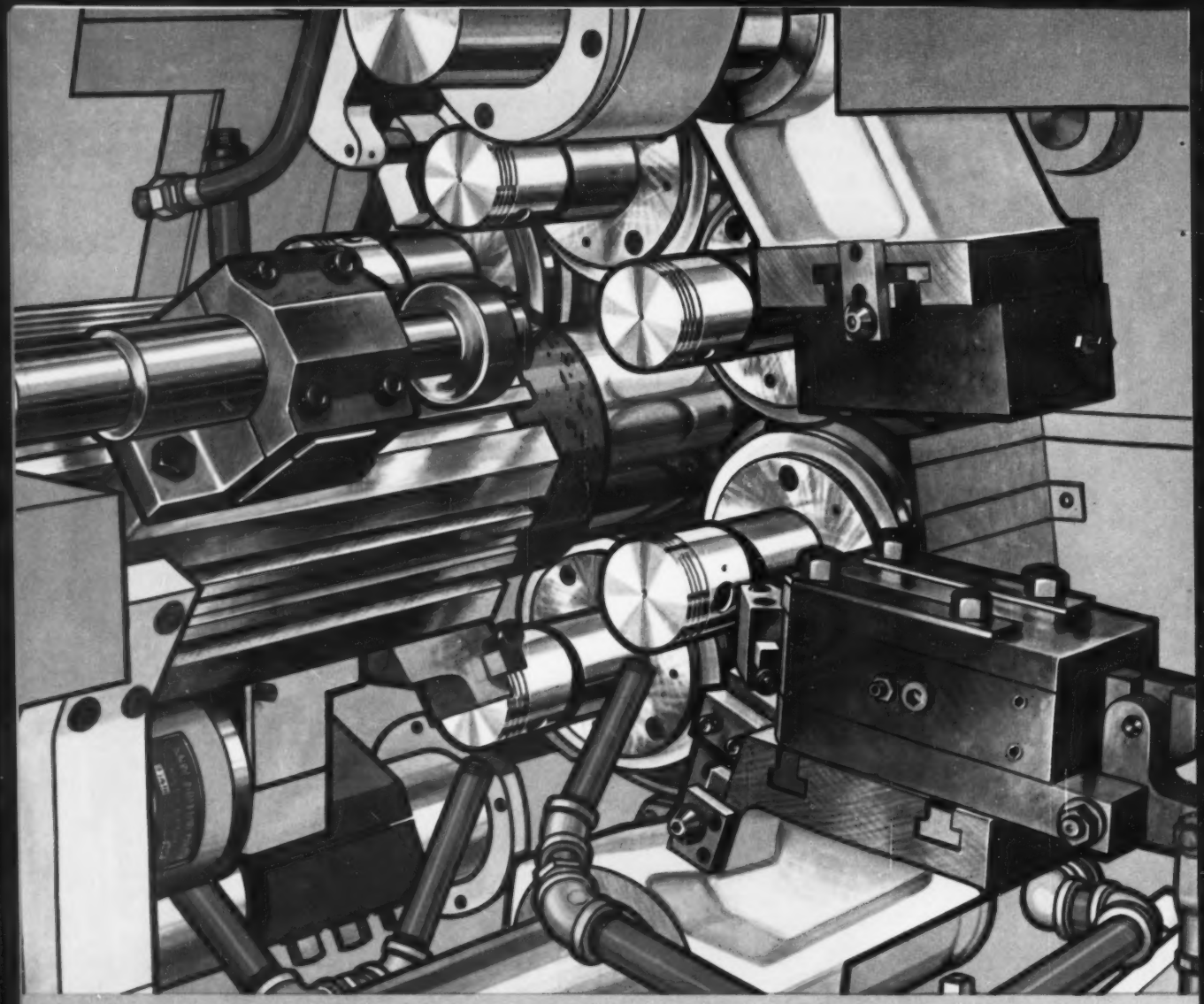
copy more than three times faster on

New Britain 4-spindle copying lathe

For the first time... multiple spindle copy turning. Loading station and three work stations. Work chucked between centers which index together. Template-controlled hydraulic slides perform copy turning; cross slides and/or forming arms perform a wide variety of additional operations. Two-speed spindles, automatic loading and unloading, and automatic chip conveyor optional. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Model 412/25 Copying Lathe



make higher production pay for itself

A New Britain four-, six- or eight-spindle chucker with open-end design, massive forming arms, large capacity (up to 15″) will machine your castings and forgings faster at less cost. You can measure it in *income* instead of *cost* because New Britain Chuckers pay as they go. New Britain's new financing plan makes large initial investment unnecessary. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NEW BRITAIN CHUCKING MACHINE

AMERICAN STANDARD INSERTED-BLADE MILLING CUTTER BODIES—1

Approved as American Standard Oct. 29, 1958

Purpose

These and four additional tables to be published in succeeding data sheets comprise the standardization covering the principal dimensions of inserted-blade cutters and their bodies. The purpose of the standard is to provide, in the user's plant, interchangeability between cutters of different makes, as well as a reduction in the number of sizes now in use.

Scope

A survey of different inserted-blade cutters in use indicated that in many cases the variation in dimensions was so slight as to have little effect on the actual cutting performance, but still was sufficient to make necessary the stocking of many sizes of cutters to perform the same operation on available equipment.

Further analysis indicated that practically all cutters could be standardized in one of five groups, and the work of standardization has been carried out on this basis. The groups are based on the type of milling to be done. Sizes are limited to a range of from 3 to 24 inches in diameter.

No attempt has been made to standardize beyond general dimensions such as outside diameters, over-all widths, arbor or center holes, as well as machine mounting and driving dimensions.

It is not intended that the establishment of these standards shall in any way preclude the specification or manufacture of special cutters where specialized operations call for cutters beyond the scope of these recommendations.

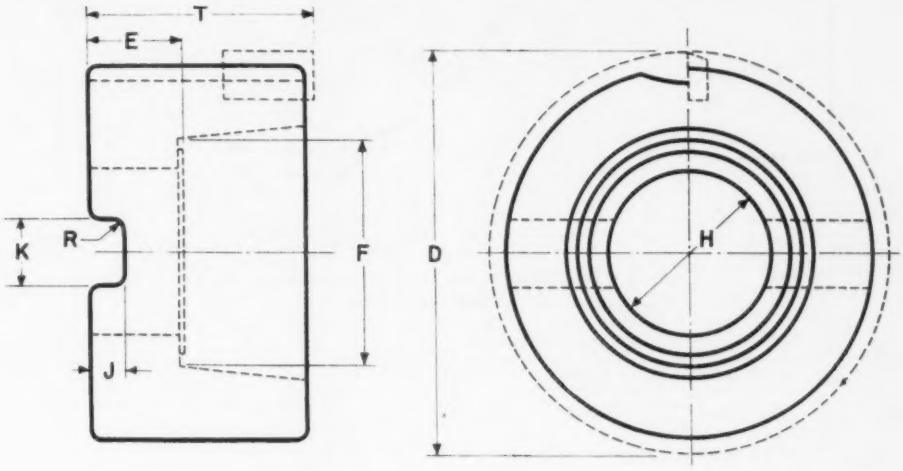


Table 1. Cutter Bodies for Shell End-Mills with Inserted Blades

General Dimensions				Counterbore	Driving Slot		
Diameter of Cutter D	Width of Cutter* T	Diameter of Hole H	Min. Bearing Length E	Diameter Min. F	Width K	Depth J	Radius Max. R
4	1 3/8 to 2 5/8	1 1/2	1	2 1/32	5/8	3/8	1/16
5	1 3/4 to 2 7/8	1 1/2	1	2 1/32	5/8	3/8	1/16
6	1 7/8 to 3	2	1	2 13/16	3/4	7/16	1/16
7	1 7/8 to 3	2	1	2 13/16	3/4	7/16	1/16
8	1 7/8 to 3	2	1	2 13/16	3/4	7/16	1/16

All dimensions given in inches.
* Optional with cutter manufacturer within range given.
Tolerances will be given in Table 6 to be published in a succeeding data sheet.

Extracted from American Standard Inserted Blade Milling Cutter Bodies (ASA B5.23–1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD INSERTED-BLADE MILLING CUTTER BODIES—2

Approved as American Standard Oct. 29, 1958

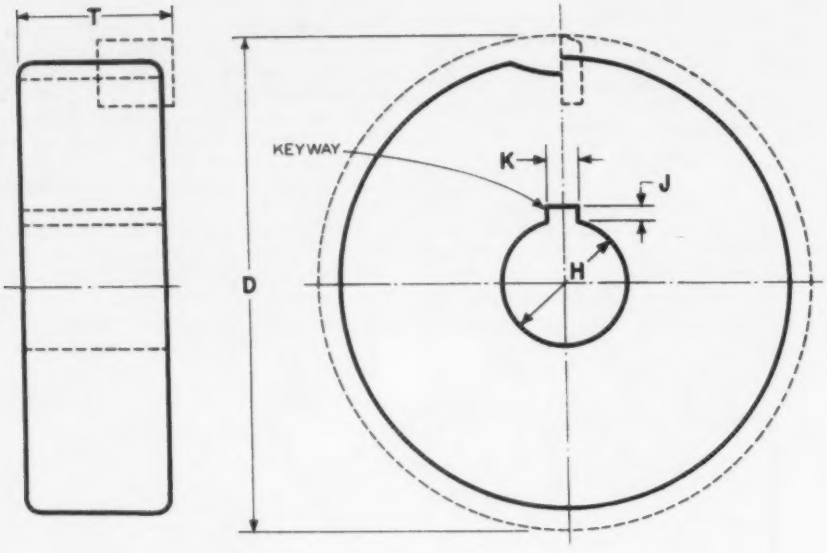


Table 2. Cutter Bodies for Half-Side Milling Cutters with Inserted Blades

General Dimensions			Keyway Sizes
Diameter of Cutter D	Width of Cutter* T	Diameter of Hole H	
4	3/4 to 1	1 or 1 1/4	All keyway dimensions to be in accordance with American Standard (ASA B5.3)
5	3/4 to 1 1/4	1 1/4 or 1 1/2	
6	1 to 1 1/4	1 1/2 or 2	
7	1 to 1 5/8	1 1/2 or 2	
8	1 1/4 to 1 5/8	1 1/2 or 2	
10	1 1/4 to 2	2 or 2 1/2	
12	1 3/4 to 2 1/2	2 or 2 1/2	

All dimensions given in inches.
* Optional with cutter manufacturer within range given.
Tolerances will be given in Table 6 to be published in a succeeding data sheet.

Extracted from American Standard Inserted Blade Milling Cutter Bodies (ASA B5.23–1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

ROUGH...TOUGH...and FAST At Dana Corporation Auto Frame Plant in Detroit, drills are really subjected to harsh treatment to give required production. 55/64" High Speed drills wham into these body cross tubes at terrific speeds and feeds. They punch through, first a disc welded onto the tube, then the tube walls, a total of 5/8", whirling out 5" blue chips up to .060" thick.

No coddling of drills here. They have to stand the gaff. And that's just what these GREENFIELD-AMPCO drills are built to do. Try them today! Call your nearest distributor.

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SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

GREENFIELD TAP & DIE GREENFIELD, MASSACHUSETTS

Better use that modern phone to call in a GEOMETRIC man and learn how New Geometrics may update your threading operations and increase your profit margin.

Geometric has no yearly model, improvements are incorporated as developed – so the newest Geometric is always the best.

CALL YOUR GEOMETRIC DISTRIBUTOR TODAY

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NEW HAVEN 15, CONNECTICUT

Each year, thousands of gallons of worn-out emulsions go down the drain

With them go millions of dollars that could be saved by controlling bacteria like these Pseudomonads

Now, ELCIDE 75 controls bacteria . . . prevents needless emulsion waste!

BACTERIA SHORTEN EMULSION LIFE. Bacteria enter soluble oil emulsions through the air, water, and normal plant debris. Feeding on the oil-water mixture, they multiply until they cause odor, corrosion, and emulsion breakdown.

WHEN EMULSIONS GO SOUR, COSTS GO UP. The machine has to be shut down, losing production and valuable time. Costly labor is required for the clean-out, recharging, and disposal of the waste emulsion. Additional soluble oil is needed, adding to the total cost of frequent recharging.

BACTERIAL PLATE COUNTS PROVE ELCIDE 75 INCREASES EMULSION LIFE. The light areas below are bacterial colonies that ruin soluble oil emulsions. The left plate shows the untreated emulsion. The center plate is the same emulsion treated with a popular germicide. The right plate proves Elcide 75's double control keeps emulsions clean and usable . . . *as much as 5½ times longer by actual plant tests.*

Untreated emulsion | **Emulsion treated with common germicide** | **Elcide 75—treated emulsion**

ELCIDE 75 IS A POWERFUL COMBINATION of Sodium *o*-phenylphenate and Sodium Ethylmercuri Thiosalicylate (Thimerosal) . . . related to one of the safest, most effective bacterial inhibitors used in the exacting field of medical surgery. Its double action controls a much wider range of bacterial growth than the commonly used germicides and "additives"; yet Elcide 75 is completely safe to employees and machinery.

JUST ONE OUNCE OF ELCIDE 75 ADDED TO EACH FOUR GALLONS OF STANDARD DUTY SOLUBLE OIL EMULSION . . .

1. **Lengthens emulsion life.**
2. **Reduces soluble oil requirements.**
3. **Reduces downtime for recharging.**
4. **Decreases disposal of waste-oil.**
5. **Preserves emulsions during extended shut-downs.**
6. **Lessens bacterial health hazards.**
7. **Reduces bacterial corrosion of machinery and products.**

If your company is not one of the many plants now using Elcide 75, we suggest you try it soon. Your own cost analysis should convince you of its value.

PRODUCT SPECIFICATIONS ELCIDE 75

(Lilly's brand of bacterial inhibitor for cutting fluids.)

Active Ingredients—Sodium Ethylmercuri Thiosalicylate (Thimerosal) and Sodium o-phenylphenate.

Package	Price per Gal.
1-gallon (4 per case) polyethylene	$8.50
5-gallon polyethylene	$8.00
55-gallon stainless steel	$6.50

Sold only through selected distributors.

ELCIDE 75™

PATENT PENDING

KEEPS COOLANTS FRESH AS A DAISY!

ELI Lilly AND COMPANY • AGRICULTURAL AND INDUSTRIAL PRODUCTS DIVISION • INDIANAPOLIS 6, INDIANA

Respirator with variable-density "Red Devil" filter announced by the American Optical Co.

"Red Devil" Respirator Filter

The development of a variable-density respirator filter, designated the "Red Devil," has been announced by the American Optical Co., Southbridge, Mass. This device has the Bureau of Mines approval for respiratory protection against all dusts not significantly more toxic than lead, pneumoconiosis-producing and nuisance mists, and chromic-acid mist. The filter is composed of two sections—a red pre-filter and the filter body. The built-in pre-filter is composed of interlocked viscose fibers and is thermally bonded to the filter body. The pre-filter is constructed to trap larger-sized airborne particles, agglomerates of smaller particles, and a reasonable amount of microscopic particles. The relatively open structure of the pre-filter results in a large storage capacity for retained particles.

The gray filter body is composed of a special combination of microfine viscose and vinyon fibers and ultrafine asbestos fibers. The viscose and vinyon fibers form a constant latticework throughout the filter body upon which the extremely fine asbestos fibers are deposited. These asbestos fibers vary in density from front to back having the heaviest concentration at the innermost part of the filter. Because of this concentration gradient, the filtering efficiency increases from front to back and rapid plugging of the filter is prevented. This variable-density feature also prevents a rapid increase in breathing resistance by the filtering action which traps larger particles at the front of the filter while allowing smaller particles to penetrate until they are finally trapped by the increasingly dense asbestos fibers.

The "Red Devil" filter is made to fit standard American Optical single- and twin-cartridge respirators. It is not affected by climatic conditions and can be stored indefinitely without deteriorating. The filter is practically weightless (300 filters weigh 1 ounce). Breathing resistance is extremely low—about 1/2 inch of water at 85 liters per minute air flow.

Circle Item 602 on postcard, page 189

Interchangeable Air Cylinder

An interchangeable air cylinder of square head design has been announced by the Tomkins-Johnson Co., Jackson, Mich. This product, called the "T-J Squair Head Cylinder," is specifically designed to produce maximum force with minimum pressures, and is also adaptable to the use of low-pressure oil as the working medium. The cylinder is available cushioned or non-cushioned, and presently comes in nine sizes with bore diameters ranging from 1 1/2 to 8 inches. It is designed to utilize air up to pressures of 200 psi or oil pressures up to 500 psi and is interchangeable with all standard JIC cylinders.

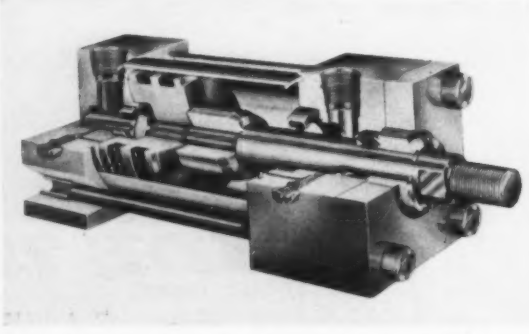
Features include "Super-Cushion" for air, along with the "Master Self-Aligning" oil cushion. Other standard features are solid steel heads and mounting plates, hard chromium-plated bodies and piston rods and leakproof cylinder-head-to-body construction. The cylinders also have heavy-duty piston rods, heavy-duty, high tensile strength steel tie-rods, and a metallic rod scraper.

Circle Item 603 on postcard, page 189

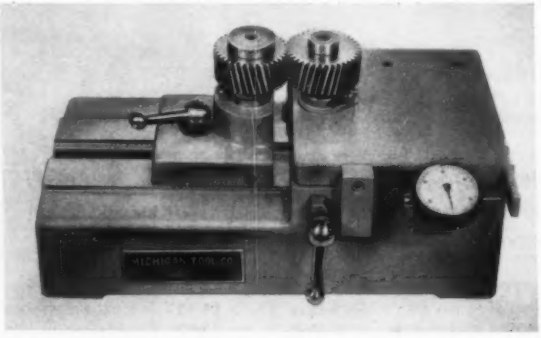
Gear-Rolling Fixture for Checking Spur and Helical Gears

A low-cost, bench type, gear-rolling fixture for accurately checking external spur and helical gears, that covers the most-used range of gear sizes, has been developed by the Michigan Tool Co., Detroit, Mich. This supplement to the company's line of gear-checking equipment is designated Model 607.

The rolling fixture will check size, eccentricity, and meshing smoothness of external spur and helical gears up to 10 inches in



Tomkins-Johnson interchangeable air cylinder



Michigan gear-rolling fixture for checking gears

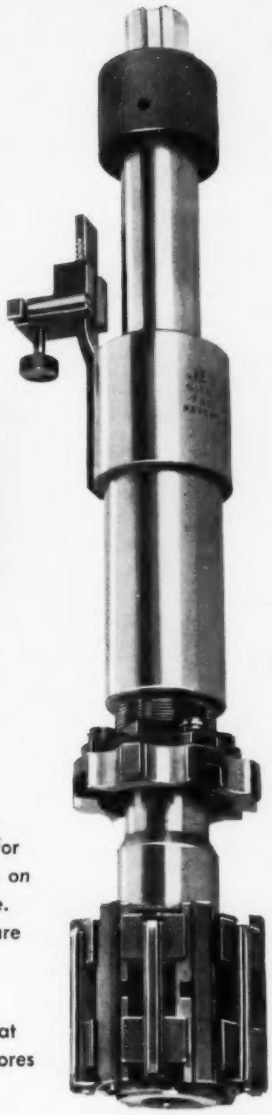
FACTS about

JES-CAL SIZE CONTROL HONING TOOLS

▶ The Jes-Cal honing tool is the most compact, combined hone equipment which has produced uniform size and accuracy consistently and dependably.

▶ Jes-Cal honing tools contain all size control elements. They function independently of the machine, and consistently show overall savings in comparative tooling, machine and operating costs.

▶ The Jes-Cal size control gage, with carbide contact points is long wearing—usually up to one or two years in high production without replacement. It operates entirely independently of friction, it has eliminated all trouble in gaging control.



▶ The Jes-Cal size control taper gage, shown above, is easily and quickly set for pre-selective desired change in final size on *the tool without removal from the spindle.* Adjustment increments of 0.00025-inch are all mechanical—positive—dependable.

▶ Jes-Cal honing tools have been successfully operated in high production at twice former conventional speeds on bores in steel parts.

▶ It has been demonstrated that the full potential advantages of Jes-Cal honing tools cannot be completely developed on most presently used machines; that heavier, all-mechanical machines may be preferable for lower cost production.

▶ For 1960 programs, Jes-Cal is accelerating completion of a much heavier, single spindle, all-mechanically operated honing machine to assure new operating and production advantages.

▶ Jes-Cal honing tools have met—or evidenced their capacity to meet—the requirements desired by leading manufacturers for higher quality, cost-cutting production.

For further information, write to:

JES-CAL COMPANY

31485 GROESBECK HIGHWAY • FRASER, MICHIGAN

diameter. This is done by manually rotating (or rolling) the gear to be checked against a master gear. All deflections are shown on an integrated dial indicator in increments of 0.0005 inch. The master-gear assembly is spring-loaded, and rides on hardened and ground ball-bearing ways. A hand-actuated cam disengages the meshing action and permits easy removal of the gear from the fixture.

A replaceable precision bushing is used on the master gear and part stud. Master-gear rotation can be in the bore of the master or in the bushing, a feature that greatly extends the service life of the equipment. The center distance is adjustable from 1 3/4 to 6 inches. The regular master-gear arbor diameter is 1 inch but other sizes can be furnished to suit specific applications. Physical dimensions are about 7 by 15 inches by 5 3/4 inches high. The rolling fixture is also designed to be used, when desired, with Michigan's Model MTR automatic recorder, to keep a record of the inspection on permanent charts.

Circle Item 604 on postcard, page 189

Nylon Feeding-Finger Pads for Automatic Screw Machines

The Brown & Sharpe Mfg. Co., Providence, R. I., has brought out nylon feeding-finger pads designed to feed stock to hand and automatic screw machines without scratching. The pads are particularly suitable for use with soft materials such as brass, aluminum, and plastics and for centerless-ground or polished stock where freedom from marking or marring the finished surfaces is important.

Nylon pads like the one illustrated are available in round, square, and hexagonal types and are designed for snug, no-slip fit on standard feeding fingers.

Circle Item 605 on postcard, page 189

B & S nylon feeding-finger pads

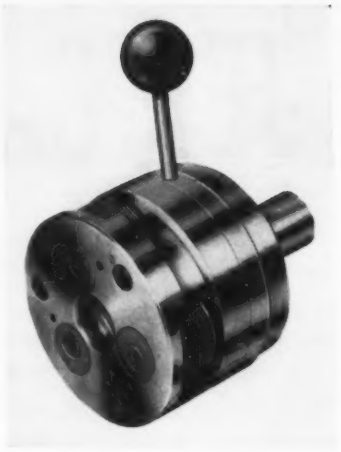
B & S Cylindrical Square

A direct-reading cylindrical square No. 558 which shows variations from square in units of 0.0002 inch directly on the cylinder and eliminates the need for transfer instruments has been introduced by the Brown & Sharpe Mfg. Co., Industrial Products Division, Providence, R. I. One end of this cylindrical square is precisely ground and lapped "out-of-square" so that when the cylinder is rotated, its angle with the base surface will at some point match the angle of the work-piece and shut out light against the work. Out-of-squareness is then read directly in 0.0002 inch by following the dotted curve nearest to the top edge of the work-piece up to the top of the cylinder.

The cylindrical square is approximately 2 1/2 inches in diameter and 6 1/4 inches high over-all and measures to a 6-inch height. Surface finish is 6 micro-inches rms or better and the diameter is ground and honed to size within 0.0001 inch. Ends are ground, lapped, and serrated to reduce friction.

Circle Item 606 on postcard, page 189

Brown & Sharpe cylindrical square



Landis No. 7 thread-rolling head

Landis Thread-Rolling Heads

The Landis Machine Co., Waynesboro, Pa., is now manufacturing No. 7 series thread-rolling heads in both stationary and revolving styles. These precision tools are made to withstand the rigors of continuous high production. The stationary head is designed for turret lathes, hand screw machines, and automatic screw machines employing a stationary type head, while the revolving head is intended for application to automatic screw machines utilizing a revolving type head. In addition, they can be applied to threading, drilling, and tapping machines.

An advantage claimed for No. 7 series heads is their ability to produce threads at high speeds without impairing roll life. Another advantage is that since thread rolls never require regrinding, the heads can be operated indefinitely without adjustment after the initial size has been established.

Both styles of heads are self-opening. The stationary head is automatically opened upon completion of the thread by interrupting the forward travel of the turret slide or carriage. Automatic opening of the revolving head results from interrupting the forward travel of the yoke.

When using these tools, lead-screw, cam, or positive feed is not required since the necessary "self leading" action is generated by

They ALL want to know about the NEW *Electrically Controlled* KING

KING
Full Electrically Controlled 36" King with Turret Head, Side Head, and Complete-Unit Coolant Pan. The New Kings are available in sizes 30", 36", 46", 56" and up, in a wide variety of head combinations, with or without side head.
MASTER MECHANIC
CHIEF ENGINEER
PURCHASING AGENT
TOOL ENGINEER
SUPERINTENDENT
FOREMAN
GENERAL MANAGER
PRODUCTION ENGINEER

Production Engineers, General Managers, Shop Superintendents, Foremen, and other operating and executive personnel in more and more plants are taking a close, *close* look at the all-new, Full Electrically Controlled King® Vertical Boring and Turning Machine. And they *like* what they find . . . things *you* ought to know, too!

It adds up to this: the new King® will give you a *greatly increased production capacity* for your boring and turning work —a production capacity that is a "must" to meet stiffer competition in these days of continuously stepped-up speed in machine tool operation and control.

For full details on the new King see your King Distributor, or write us direct . . . *now!*

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- Full Electrical Control—"pushbutton" speed for fast set-up and control.
- Greater Power Reserve—40 and 50 HP on 30", 36" and 46" sizes; 75 and 100 HP on sizes 56" and up.
- Expanded Speed and Feed Ranges—pre-selective with direct-reading dials for 24 speeds in any one of three standard ranges, 24 feeds from .0016 to .250 per revolution.
- New Spindle and Spindle Mounting—table stability that establishes a wholly new higher standard for maintained accuracy.
- Optional Equipment for Additional Increase in Productivity—Automatic Cycling . . . Automatic Positioning of Heads . . . Automatic Tracing Control of Heads . . . Power Rail Clamping.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

KING Vertical Boring and Turning Machines

the thread rolls mounted on roll shafts inclined to the proper helix angle.

To provide maximum rigidity and direct positive drive, the shank of the stationary head and the operating ring of the revolving head are keyed to the head body by involute splines. The outer ends of the roll shafts are rigidly supported by a retaining cap mounted on three triangular posts which are integral with the head body.

The outstanding feature of the No. 7 series is the use of replaceable helix-angle bushings. By the use of a "mean" angle, one set of standard bushings functions to roll both UNF (Unified Fine) and UNC (Unified Coarse) threads. When the exact helix angle is required, the proper helix-angle bushings can be substituted. Thus the need of a special head is eliminated.

Changes in diameter are accomplished by substituting the proper rolls for the diameter and pitch to be rolled. Minute plus or minus adjusting can be quickly and easily done by loosening and tightening the opposed set-screws in the adjusting ring. The thread rolls in the No. 7 series heads are designed to be reversed so that both ends can be used to prolong tool life. These rolls incorporate easily serviced caged needle bearings. The No. 7 series stationary and revolving thread rolling heads are made in sizes ranging from 7/16 to 7/8 inch UNF and UNC right-hand threads.

Circle Item 607 on postcard, page 189

G-E Tool-Holders, Tool Bits, and Convertible Seats

A line of tool-holders for positive-rake disposable inserts of the design shown in the upper view of the accompanying illustration has been announced by the Metallurgical Products Department of the General Electric Co., Detroit, Mich. Fifty-four different holders, both right- and left-hand, and in a variety of shank sizes are available in the Lift-O-Matic line. Positive-rake tool-holders are especially valuable for light- and general-purpose work. They are particularly applicable where tool

Tool equipment available from Metallurgical Products Department of General Electric Co. (Top) Positive-rake Lift-O-Matic tool-holder; (center) Carboloy tool bit designed for rigidity; (bottom) Carboloy convertible seat for tool inserts

pressure on the work-piece must be kept low, as in machining tubing, long thin sections, soft, gummy materials, soft steels, aluminum, or high-temperature super alloys.

These tool-holders will accept standard, disposable triangular inserts in 3/8- to 1/2-inch inscribed circle sizes with a thickness of 1/8 or 3/16 inch. Square inserts also can be used in 3/8- to 3/4-inch square sizes 1/8 to 3/16 inch thick.

The CC-11 machine bit of 1 1/2-inch gage shown in the center view of the illustration is also now available. This bit is designed with the same rugged features of the proved CCS-2 bit. Reduced tool overhang and the "enclosed cylinder" tip serve to reduce breakage. With this bit design full advantage is taken of the exceptionally high compressive strength of Carboloy cemented carbide. The shorter 1 1/2-inch gage reduces leverage of the cutting forces which cause shank bending or breakage. With the carbide tip enclosed in steel and retained both by brazing and mechanical holding, tip loss is said to be drastically reduced, and down time minimized.

Instant conversion of standard triangular insert tool-holders into universal type holders is now possible with a line of G-E convertible seats like the one shown in the lower view of the illustration. This convertible seat reduces tool-holder inventories and permits lighter or heavier inserts to be used in the same tool-holder without altering the tool setup or removing the holder. In many applications the standard type tool-holder will accept only inserts actually too heavy, too light, or uneconomical for the job. As a result, extra stocks of varied tool-holders must be available, with added overhead and storage problems. With the new Carboloy convertible seats the standard tool-holder capacity is extended and inventory and supply problems are reduced. One tool-holder can use up to four different inserts for light, medium, or heavy cutting.

Savings now can be made with the newly available Carboloy 7/16-inch I. C. disposable insert which is especially valuable for machining applications that are too heavy for the 3/8-inch I. C. insert but not heavy enough for the 1/2-inch I. C. insert. Assembly and disassembly of the tool-holder remains easy, with only one set-screw to remove and replace. Nine convertible seats adapt Lift-O-Matic tool-holders for inserts up to the 5/8-inch size.

Circle Item 608 on postcard, page 189

Lukens "Play-Mate" Electrodes and Wires

New "Play-Mate" welding electrodes and wires recently introduced in the Chicago and Coatesville areas by Lukens Steel Co., Coatesville, Pa., are now available to steel-plate fabricators in the Boston, New York, and Richmond areas. A complete range of welding electrodes and wires specifically matched to its own complete range of alloy and carbon steel plates is now available from the Lukens Steel Co.

Circle Item 609 on postcard, page 189

(This section continued on page 194)

introducing a

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HEAVY DUTY PRECISION BORING MACHINE

Designed for better precision finishing...semi-finishing...and roughing of large, bulky parts

This newest in the line of Olofsson Precision Boring Machines, the Model 22, is designed for more profitable heavy-duty rough and finishing boring, facing, chamfering, turning and grooving operations. Put one to work . . . and profit potential goes up. Because of the versatility of its new design, operating costs go down.

MODERN, WITH 22 QUALITY-DESIGN FEATURES, the Olofsson Model 22, weighs a hefty 7,600 lbs., untooled; and incorporates such design features as:

- *Extremely low ratio, height to width, of spindles to ways.*
- *Hardened and ground Alloy Steel flat and vee ways.*
- *Extra-large fixture mounting provides maximum stability for mounting large work pieces.*
- *Integral chip chutes completely surround any fixture tooling.*

WHATEVER YOUR PRODUCTION REQUIREMENTS. IT WILL PAY YOU TO FULLY INVESTIGATE THE MODEL 22. CONTACT YOUR NEAREST OLOFSSON REPRESENTATIVE. Or, if you prefer, write direct to OLOFSSON.

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Technical-ities

By John S. Davey

Quick facts on cold heading

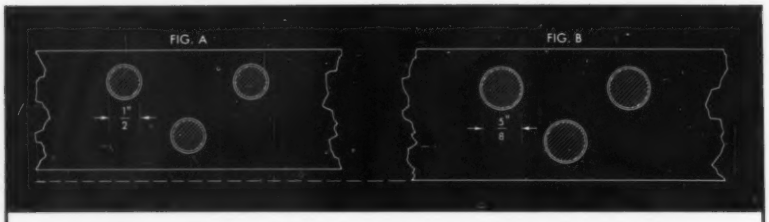
Compared to machining, cold heading gives stronger pieces at less cost. Also, the headers automatically control quality because unsound material cannot be used. While the scope of cold headers is wide indeed, it pays to design for them right at the start.

Some rules of thumb to guide you:

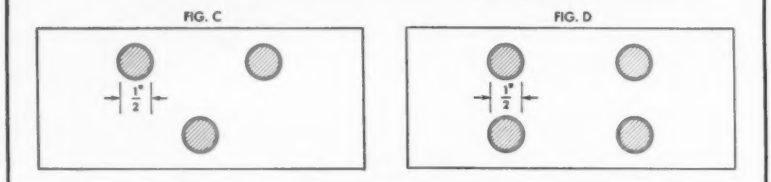
1. You save money after a run of 25,000 pieces (which pays for the set-up).
2. Maximum length of parts runs about 6 inches. For straight upsetting, maximum diameter is about 4½ times that of shank. (With special operations, up to 26 diameters have been achieved!)
3. Various metals and alloys are suitable. But keep carbon content in steel to under 0.45.
4. Concentric pieces are easier to form, though eccentric and serrated shapes are practical.
5. Avoid sharp corners. Allow generous radii.
6. Because upsets are usually cylindrical, oval or round shapes take less trimming than square or rectangular.
7. Hollow upsets tend to form cracks at edges of recess, so avoid them.
8. Embossing raises costs.
9. No problem heat treating short sections. But long sections are apt to be distorted.

When in doubt, contact an expert in cold heading.

How high strength fasteners affect the holes they fill



RB&W high strength fasteners, with a capacity close to or larger than the next larger size bright cap screw or machine bolt... PERMIT SMALLER HOLES... OR FEWER HOLES.



As simple a matter as the selection of fasteners can permit changes for better design... and also improve production costs and service life.

In sketch "A", for example, you see one difference from use of RB&W high strength fasteners instead of machine bolts or bright cap screws, as in "B". You use a smaller size fastener. Holes are therefore smaller. The metal section, in turn, can then be smaller for a saving in material and weight. The costlier the materials (copper bus bars as a case in point), the more significant the cost savings.

In sketch "C", fill the 3 holes with ½" high strength bolts, and you have a load capacity close to 40,000 pounds. That's the same as developed by 4 bright cap screws filling holes in Sketch D. It costs less to drill and less to fill the 3-hole design.

RB&W High Strength Fasteners are now identified by this new marking as well as 3 radial dashes. They have the proper balance between ductility and hardness required in high carbon units.

EFFECT ON PERFORMANCE AND PRODUCTION

When tightened to their full load, high strength fasteners not only *stay* tight—even under vibratory conditions—but also exert high clamping force. It has been shown that, under high compressive forces, hole areas gain extra resistance to fatigue cracks.

What's more, the high friction developed virtually locks members together, prevents slippage. Holes, therefore, need not be perfectly aligned since they can even be slightly oversized without detriment.

There's an RB&W Fastener Man ready to aid you in working with high strength bolts—in the design stage or as replacement for SAE grade 1 or 2 steel fasteners or for rivets. Write for helpful booklet DC-1, Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

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NEW CATALOGUES

BEARINGS AND BUSHINGS—Wakefield Bearing Corporation, Wakefield, Mass. Catalogue on Graphex, Coprex, and Woodex oilless and self-lubricating bearings, bushings, and machine parts, a valuable reference guide for sintered metal parts. A highlight of this catalogue is a group of detailed full color and black and white microphotographs graphically illustrating metal structures in various stages of development. For a free copy write on company letterhead to the Wakefield Bearing Corporation, 29 Foundry St., Wakefield, Mass.

SERVO SYSTEM COMPONENTS—Oilgear Co., Milwaukee, Wis. Four bulletins presenting a new line of electrohydraulic servo-system components. Bulletin 36100, "New Electrohydraulic Servo Valves," illustrates and describes the construction and principle of operation of this plungerless valve design. Bulletin 36200, "New Power Amplifier," covers the specifications and operation of Servocontrol Division's universal type amplifier. Bulletin 36300, "New Preset Units," illustrates and describes the construction and specifications of these units. Bulletin 36400, "New Panels," illustrates many of the different forms and types of "Custom-Built" amplifier and control panels built by Oilgear-Servocontrol for operating electrohydraulic servo systems. .**501**

PRECISION TOOLS—Brown & Sharpe Mfg. Co., Industrial Products Division, Providence, R. I. Bulletin M81, showing the latest developments in the company's line of precision tools. Convertible thimble micrometers with a range of from 0 to 1 inch by 0.0001 inch, height gages with new versatility and stability, a "Super Hite Chek," self-contained transistorized unit that reads in 25 millionths, tool-setting gages, edge finders, radius gages, sine plates, dial snap and bore gages, permanent magnet chucks, and precision-ground tool steel are some of the products featured. **502**

MILLING AND BORING—Ingersoll Milling Machine Co., Cutter Division, Rockford, Ill. Book entitled "Winning Combinations That Reduce the Cost of Chips," which tells how to improve milling and boring operations at reduced costs. Among subjects discussed are: (1) importance of matching cutters to the exact capabilities of machines and to the work; (2) a sure way to get maximum performance from replacement blades; (3) setup and cutter sharpening equipment; (4) description of typical milling and boring cutters, tool designs, and factors affecting their selection. **503**

HOLE GAGE—Sunnen Service Corporation, St. Louis, Mo. Bulletin SSC-B1, giving complete information on operation, application, and cost of the corporation's No. PG-800 gage and PG-400 setting fixture. Details include large-size pictures of both units, as well as interesting examples of how the setting fixture can be used to set the gage to dimensions of 1/2 tenths (0.000050 inch) without the use of masters, rings, or setting blocks. . . .**504**

CUTTING TOOLS—Wendt-Sonis Co., Hannibal, Mo. Catalogues showing the large selection of carbide cutting tools, blanks, and inserts manufactured by the company. Catalogue No. 59 has 72 pages of reamers, drills, end-mills, milling cutters, counterbores, single-point tools,

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blanks, and inserts. Catalogue No. 59-A illustrates a complete line of Wendt-Sonis mechanical tool-holders, both negative and positive styles, with inserts, chip-breakers, and replacement parts. . . . **505**

FLEXIBLE COUPLINGS—Lord Mfg. Co., Erie, Pa. Bulletin No. 205, describing standard and specially engineered bonded-rubber flexible couplings. It contains detailed specifications for three standard shear type flexible couplings, 1/50 to 100 hp at 1750 rpm. The formula for selecting the correct standard coupling for other speeds is given. **506**

FURNACE SELECTION CHART—C. I. Hayes, Inc., Cranston, R. I. Simplified chart which makes it possible to relate application requirements directly to furnace and atmosphere equipment. It details over 100 different materials and operations. In addition to the particular furnace design recommended, the chart shows the type of heating element it uses and the maximum temperature range. **507**

PRECISION GEARS—General Electric Co., Schenectady, N. Y. Bulletin GEA-6430, describing high-performance, precision gears from less than 1 inch to over 200 inches in diameter and with tooth-to-tooth spacing accuracies of two ten-thousandths of an inch. Typical applications of precision gears include high-speed industrial gear units, marine gear units, aircraft power and accessory gears, etc. **508**

BAND SAW—Henry G. Thompson & Son Co., New Haven, Conn. Circular describing its "Milband" band-saw machine tool, said to be the first band-saw machine specifically designed and constructed from the base up to provide the ruggedness, rigidity, variable speed ranges, and other characteristics needed to deliver the full cutting capacity of high-speed steel band blades. **509**

RESISTANCE WELDING—Federal Machine & Welder Co., Warren, Ohio. Bulletin entitled "Federal PP-54," describing resistance welding in all phases—spot welding, projection welding, seam welding, flash welding, etc. It gives the user a good working knowledge of the basic principles of resistance welding, including a resistance welding formula, data on how to calculate welding pressures, time in cycles, etc. **510**

CUTTING FLUID—Cincinnati Milling Products Division, Cincinnati Milling Machine Co., Cincinnati, Ohio. Brochure, "Cimcool Cimperial" (PC-359), describing an entirely new solution type cutting fluid, especially designed to replace cutting oils on heavy-duty operations. The brochure explains the features of this chemical solution and also contains a chart of recommended dilutions. . . . **511**

PARTS WASHER—Gear-O-Mation Division, Michigan Tool Co., Detroit, Mich. Descriptive data sheet (Bulletin No. 574) covering a high-level parts washer for parts that roll. It is specifically designed for automated gear-processing lines, is used without part elevators as it is built to any applicable height, and "jet" washes and blows off up to 950 parts per hour. **512**

NICKEL-BASE ALLOY—Haynes Stellite Co., Division of Union Carbide Corporation, New York City. Booklet discussing how stress-corrosion cracking—a long-standing problem in the chemical field—has been brought under control by use of a nickel-base alloy. "Hastelloy" alloy F resists oxidizing and reducing conditions in addition to its particular resistance to stress-corrosion cracking. **513**

CASTINGS—Malleable Research and Development Foundation, Granville 1, Ohio. Handbook furnishing an introduction to pearlitic malleable, as well as a ready reference to the latest information and data on this relatively new material. It contains ten tables, nineteen charts, and fourteen illustrations. **514**

GEARS—Pic Design Corporation, Subsidiary of Benrus Watch Co., Inc., East Rockaway, L. I., N. Y. Booklet titled "Better Products for Automation through Standardization," containing pictures, engineering drawings, and engineering data for the everyday application of precision gears and allied components. **515**

REFERENCE CHART—Lebanon Steel Foundry, Lebanon, Pa. New and revised reference chart containing fifty-five of the more widely used cast alloys in the carbon, low-alloy and stainless-steel groups; also, nickel and Monel. In addition to all standard data such as composition, physicals, etc., the chart contains a new section for design applications of each steel alloy. **516**

THREAD-ROLLING—Reed Roller Thread Die Co., Holden, Mass. Bulletin B111-1, giving complete information on the Reed Model B111 two-die type, horizontal, cylindrical-die thread-rolling machine. The bulletin illustrates the flexibility of the machine for either large or small quantity production. **517**

WELDED ASSEMBLIES—American Welding & Mfg. Co., Warren, Ohio. Catalogue supplying quick reference to welded assemblies produced by the company for commercial and military purposes. Such pertinent information as material, size, weight, manufacturing processes, and testing requirements accompany the photographic illustrations. **518**

SHELVING—Standard Pressed Steel Co., Jenkintown, Pa. Brochure (Form 2451) featuring quick-change, bracket type shelving and a broad line of steel shop equipment. The Erectomatic shelving is designed around a simple, thumb-operated locking device, and has quick initial erection and beaded-post design. **519**

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FASTENERS—Abbott Screw & Mfg. Co., Chicago, Ill. Catalogue listing the thousands of fasteners of all types carried in stock by the company. Abbott's manufacturing divisions—stamping, cold-heading, and screw machine—are described and illustrated with typical samples of work produced. **520**

GAS REGULATORS—Air Reduction Sales Co., a Division of Air Reduction Co., Inc., New York City. Catalogue (Form ADC 705 F) covering the company's complete line of cylinder, manifold, and station pressure regulators. The booklet contains flow and pressure specifications, as well as inlet and outlet connection dimensions, for each regulator. **521**

ELECTRICAL STANDARDS—National Machine Tool Builders' Association, Cleveland, Ohio. Report of the Electrical Standards Committee of the NMTBA, entitled "Summary of Major Differences," listing and describing forty-nine basic differences between the Machine Tool (NMTBA) Electrical Standards and those of the Joint Industry Conference (JIC). **522**

FIRE-RESISTANT CLOTHING—American Optical Co., Southbridge, Mass. Circular describing a new series of "Fyre-Free" fire-resistant clothing which has been added to the company's line of protective clothing. **523**

STAINLESS STEEL—Armco Steel Corporation, Middletown, Ohio. Brochure (P. O. 5758) presenting information about stainless steel. Described are new grades and finishes, new facilities, faster service, many grades, shapes and sizes, and the company's "Stainless Steel Library." **524**

MILLING MACHINES—Kearney & Trecker Corporation, Milwaukee, Wis. Booklet describing procedure whereby the company's used machines are remanufactured to "like new" condition. **525**

COOLANT UNIT—Admiral Engineering Co., Inc., Chicago, Ill. Brochure featuring a "Cool-Cut" tool saver, a unit for carrying coolant and maintaining it at proper temperatures. **526**

COATED TUBING—Armco Steel Corporation, Middletown, Ohio. Folder (P.O. 5558), telling how designers use special coated steel tubing for various products and parts. Properties of Zincgrip and aluminized steel Types 1 and 2 are described and O D's and gages are recommended for typical products. **527**

THREAD - ROLLING ATTACHMENTS—Landis Machine Co., Waynesboro, Pa. Bulletin 1-400-2, on Lanroll thread-rolling attachments containing all the necessary information on operation and repair parts. A section has been incorporated which shows the applications of the attachments to each of the popular sizes of automatic screw machines and turret lathes. **528**

CHART—Ohio Seamless Tube Division, Copperweld Steel Co., Shelby, Ohio. Decimal equivalent chart, showing fractional units from 1/64 to 1 inch. Equivalents are neatly defined in blue and black for easy reference. **529**

BORING TOOLS—Muskegon Tool Industries, Inc., Muskegon, Mich. Catalogue describing rough- and finish-boring and reaming tools. **530**

MACHINING OF HONEYCOMBS—Anocut Engineering Co., Chicago, Ill. Bulletin describing interrupted-arc method of shaping honeycomb, a new development for high-speed machining of stainless-steel and aluminum honeycomb core. ...**531**

ALLOYS—Western Brass Sales, Metals Division, Olin Mathieson Chemical Corporation, East Alton, Ill. Brochure giving detailed listing of the properties, forms, and composition of wrought copper and copper-base alloys. **532**

POWER PRESSES—Sales Service Mfg. Co., St. Paul, Minn. Bulletin No. 1158, presenting 2- and 5-ton Press-Rite power presses in the "Juniorline" series, which includes bench and floor styles in standard, deep-throat and air-friction-clutch models. **533**

STARTERS—Cutler-Hammer, Inc., Milwaukee, Wis. Booklet (EN-150) describing the company's Three Star line of A-c magnetic starters, including starters in NEMA sizes 0 through 4 for both reversing and non-reversing single-phase and squirrel-cage motors. **534**

LATHE — Challenge Machinery Co., Grand Haven, Mich. Folder No. 865, presenting features of a small, semi-automatic precision turret lathe. **535**

BEARINGS—Hoover Ball & Bearing Co., Ann Arbor, Mich. Bulletin No. 106, giving descriptions and dimensional data on

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the company's S P series self-aligning pillow blocks, S F series flange mountings, and SBG and SB series spherical-seat machine units. Other units and components are also included. 536

PUNCH PRESSES—Kenco Mfg. Co., Los Angeles, Calif. Circular presenting 2- and 5-ton models of the Kenco punch presses. 537

SWITCHES—Micro Switch, a Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill. Revised Catalogue 101d, covering the representative line of precision snap-action and mercury switches. It has photos, dimensions, electrical ratings, characteristics, and application information. 538

JIG-BORER—Moore Special Tool Co., Inc., Bridgeport, Conn. Brochure giving details and features that make the Model No. 3 Moore precision jig-borer capable of locating and boring holes to less than a "tenth." 539

CUTTING TOOLS—Rico Tool Co., Saginaw, Mich. Booklet featuring a complete line of cutting tools. Included are solid carbide end-mills, die-sinking cutters, keyseat cutters, grinding burrs, chucking reamers, carbide twist drills, slitting saws, countersinks, rotary cutters, spade drills, boring tools, and miniature lab mills. 540

GRINDERS—Chicago Wheel & Mfg. Co., Chicago, Ill. Catalogue (Bulletin No. 6065) featuring Hi-Torque Handee and Hi-Power grinders and accessories. It also shows mounted wheels, saws, brushes, cutters, drum sanders, and bands which are available for use with the Handee. 541

CUTTING MACHINES—Motch & Merryweather Machinery Co., Wink Cutter Division, Cleveland, Ohio. Bulletin W-100, covering a line of high-speed rubber and plastic cutoff equipment, for automotive, aircraft, electrical, and other industries. 542

INTEGRAL-SHAFT SHEAVE—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin 20B7897B describing how integral-shaft sheaves are available with lubrication systems designed and engineered to assure distribution of lubricants to all moving parts. 543

DRILL STANDS—Thor Power Tool Co., Aurora, Ill. Bulletin No. 10406, giving use and applications of magnetic drill stands. It describes precision drilling possibilities in difficult or remote areas utilizing magnetic drill stands whose base "locks" to any ferrous surface. 544

CONTROL VALVES — Beckett - Harcum Co., Wilmington, Ohio. Bulletin illustrating and giving detailed descriptions and specifications on Beckett "Hi-Cyclic" air and hydraulic control valves. 545

SPLIT BALL BEARINGS—Split Ballbearing, a Division of MPB Inc., Lebanon, N. H. Catalogue 58, describing ball bearings of single- and double-fracture group. Catalogue 59, featuring ultra-precision thin-section instrument bearings. ..546

BEVEL GEAR MACHINE — Gleason Works, Rochester, N. Y. Brochure featuring No. 109 Revacycle machine for the cutting of straight bevel gears. 547

PUSH BROACH—Baj Tool Co., Cleveland, Ohio. Circular describing the new Baj one-pass production push broach. 548

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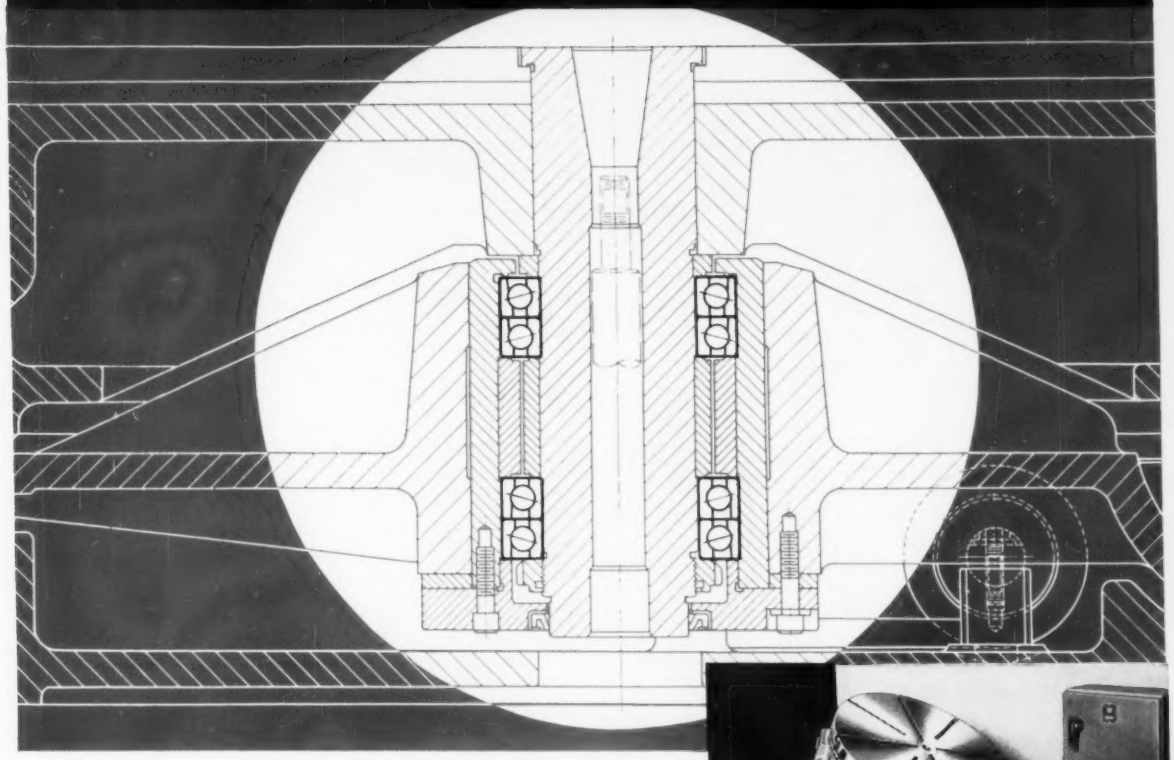
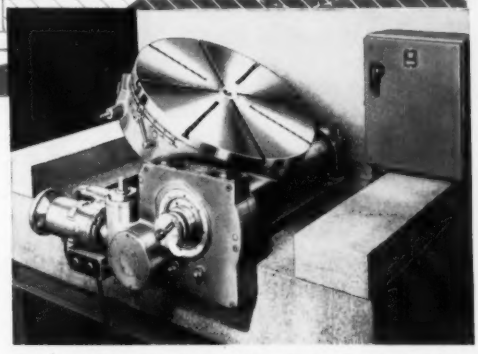




PRATT & WHITNEY
equips for precision with
FAFNIR BALL BEARINGS

The extreme accuracy designed into Pratt & Whitney's 36" Tilting Rotary Table puts a heavy premium on bearing performance. For the critical central pivot application, Fafnir super-precision ball bearings are specified.

Here are bearings with the capacity and rigidity to hold a ton-and-a-half table at *seconds of arc* accuracy — and maintain this precision under large-job work loads.

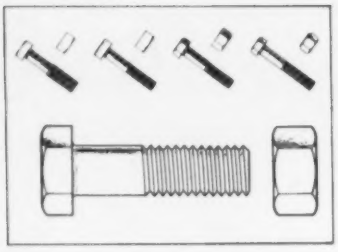
It takes plenty of bearing to deliver performance like that! Yet the application is typical of many in Fafnir's files. Fafnir's "experience in precision" can help *you* solve a bearing problem. Write The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

Pratt & Whitney 36" Precision Tilting Rotary Table is designed for large jobs requiring precise circular spacing and angular positioning. It is completely powered . . . makes possible several machining or inspection operations with a single setup . . . permits direct rotary vernier readings to two seconds of arc over a 360° range and tilting vernier readings to one minute of arc over a 90° range, with a sine bar arrangement for setting table tilt accurately to seconds.

Fafnir Super-Precision Ball Bearings, counterbore construction, support the central pivot of the table component in Pratt & Whitney's 36" Tilting Rotary Table. Mounted in tandem duplex pairs, they provide the exceptional rigidity necessary for this precision application.

For more data, circle this page number on inquiry card



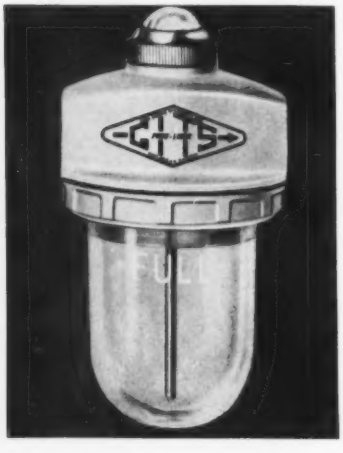
Hexagonal Bolt and Nut to Replace Square Types

Hexagonal bolt and nut (lower view) called the "Hex and Hex Fastening" developed by Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y., to replace square-head and other types of fastening bolts and nuts. This new product has been developed to consolidate in one hex bolt and hex nut the best features of the four other types of fasteners shown in the small upper views. Advantages claimed for the "Hex and Hex Fastening" are an improved quality of fastener which affords a better appearing and lighter-weight finished product. It is said to provide, at no extra cost, easier and faster assembly, plus simplification of specifications and parts to be stocked.

Circle Item 610 on postcard, page 189

Gits Air-Line Lubricator

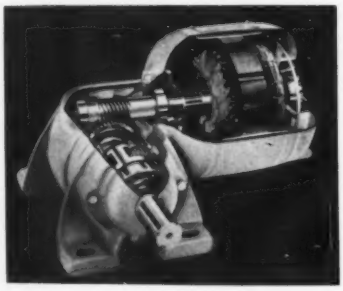
Low-cost air-line lubricator, called the "Pneu-Liner," made by Gits Bros. Mfg. Co., Chicago, Ill. This device is designed specifically for use in air-line lubricating applications where few adjustments are necessary once the initial setting is established. The design is said to have made possible important production economies. The 1/2-inch size provides even mist lubrication for any amount of air from 3/4 cubic foot up to 90 cubic feet per minute.



Circle Item 611 on postcard, page 189

Electra Double-Reduction Gear-Motor

Combination single planetary gear-motor made by Electra Motors, Inc., Anaheim, Calif. This integrally mounted unit provides the low speeds of double-reduction units with the advantages of exceptionally compact design and light weight. Fast heat dissipation and light weight are features made possible by the frame of heat-treated aluminum alloy. Insulation is of Glamicone, a glass-mylar-silicone combination. Units are available in foot- or ring-mounted frames in sizes from 1/4 through 1 hp in a speed range of 38 through 3 rpm.



Circle Item 612 on postcard, page 189

Goggle for Use When Welding and Chipping

Softside vinyl-plastic goggle for use when performing welding and chipping operations added to the line of welding accessories made by the Air Reduction Sales Co., a Division of Air Reduction Co., New York City. Frame is made of a soft but durable and flame-resistant vinyl plastic. Material is extremely light in weight and conforms easily to contours of the operator's face. The eye-piece adapter is molded of a more rigid plastic material which permits the raising of both eye-pieces as a unit without disturbing prescription glasses worn underneath. The design specifications of the frame meet government specification GGG-G-531. A cover lens protects the 50-millimeter, green filter lenses which are available in shades 3 to 6 for welding use. Replacing the cover and filter lenses with hardened lenses adapts the goggles for chipping and grinding protection.

Circle Item 613 on postcard, page 189

Collet-Stop Set

Collet-stop set with spring ejectors and solid stops available from the General Gauge Guild, Sun Valley, Calif. This GM5C collet-stop set is universal in its applications to lathes, second-operation machines, air collet fixtures, speed collet chucks, indexing fixtures, and many other adaptations. All standard, 1-inch capacity collets can be used in the regular manner, as solid-stop or spring-ejector collets.

Circle Item 614 on postcard, page 189

(*This section continued on page 196*)

How the Lindner Jig Borer's Optical Measuring System reduces tooling costs

at F. J. Stokes

Lindner Model LB15A has 44" x 24" table with exclusive AUTOPOSITIONER® for pre-selecting initial and repeat table settings.

Production Jig Boring and Inspection at Stokes—51 holes, .750" diameter, 9" to 15" deep, in head of rotary tablet machine held to +.0005", —.0000" on Lindner Model LB15A. Holes are perpendicular to the base and parallel to each other within .0005".

"*Greater accuracy in jig boring* proved to be the key to more economical tooling," says Bill Kale, Chief Production Engineer at F. J. Stokes Corp., Philadelphia. "When we installed a Lindner, costs were substantially reduced."

How does the Lindner achieve this greater accuracy? Through a unique optical measuring system. Here's how it works:

There are no lead screws. No gage blocks. No bars or limit switches. The helically scribed, cylindrical measuring scales are touched by a light beam *only*. These scales are independent of the table movement mechanism and immovable in axial direction. Thus, the whole system is permanently protected against any mechanical wear whatever. Lifetime accuracy. And lifetime *economy!*

Says Mr. Kale: "Before installation of the Lindner, it was impossible to achieve such consistent accuracy. Manufacture of tooling and laying out complex jobs has now been greatly simplified. And the Lindner optical measuring system makes it possible for us to inspect the work *right in the machine.*"

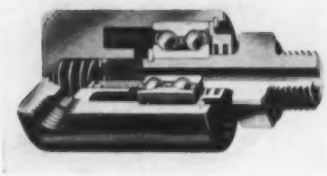
The Lindner optical measuring system is changing ideas about jig boring all over the country. We've packed all the facts into an informative 25-minute movie film. Send for it today without obligation, or write for literature.

KO CO., INC. PRECISION MACHINERY

KURT ORBAN

COMPANY, INC.

42 Exchange Place, Jersey City 2, New Jersey



Fawick Rotorseals

Cut-away view of one of a standard line of Rotorseals with factory-lubricated and sealed-for-life ball bearings now available from the Fawick Airflex Division, Fawick Corporation, Cleveland, Ohio. These compact devices are designed for transmitting air, liquids, or gases from stationary sources into rotating shafts. They are applicable to all types of single-passage applications at pressures up to 150 psi. The B2 model will operate at speeds up to 4000 rpm, and the C2, up to 3000 rpm.

Circle Item 615 on postcard, page 189

Starrett Master Vernier Height Gage

Vernier height gage introduced by the L. S. Starrett Co., Athol, Mass., which has precision features designed to make layout and inspection work easier, faster, and more accurate. This instrument is called the "Starrett No. 254 Master Vernier Height Gage." It has a long,- fifty-division, flush-fitting vernier and a sensitive, full-length slide adjustment with quick-adjusting screw release. It is of rugged, vibration-proof design with natural-grip base and fine-adjustment knob. Other features include full-range, direct-reading design, satin-chromium, no-glare finish, and hardened and stabilized master bar.

Circle Item 616 on postcard, page 189

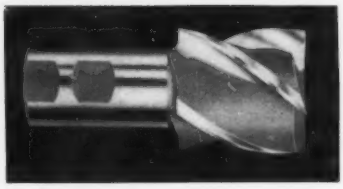
Optical Flats of Fused Quartz or Pyrex Glass

A full line of optical flats is now available in either clear, fused quartz or Pyrex glass from the Crane Packing Co., Morton Grove, Ill. These optical flats are supplied in two certified accuracies, 1/10 or 1/5 light band, to cover a wide range of flatness reading requirements. Both types are double-surfaced to avoid reading errors which commonly result from using the wrong side of a single-surface flat. Known as "Lapmaster" optical flats, they are the product of a special manufacturing technique and laboratory control said to be capable of producing flats of the finest quality. They are furnished in standard sizes from 1 inch through 12 inches in diameter and are individually packaged in a sturdy leatherette-covered, velvet-lined box with hinged cover and spring catch to provide full protection from dirt and breakage. All are banded for quick identification.

Circle Item 617 on postcard, page 189

Tomkins-Johnson Milling Cutters

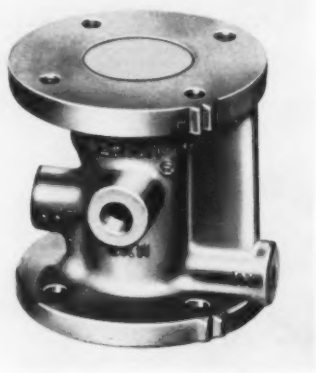
One of a new "E" line of milling cutters added to the regular line of die-sinking and milling cutters made by the Cutting Tool Division of the Tomkins-Johnson Co., Jackson, Mich. The cutters in the new "E" line are designed to have a high helix angle, double back-off, and a right-hand spiral. These features help the user obtain more cuts between grinds by giving a free cutting action, a smoother surface, and a stronger tool. The cutters are specially applicable to slab milling, die-sinking, and production milling. They are available in sizes from 2 inches in diameter with flutes 2 inches long to 2 3/4 inches in diameter with flutes 6 inches long. Flats for setscrews are standard on all shanks.



Circle Item 618 on postcard, page 189

Ross Air Valve with Time Delay

Air valve which extends the time delay of standard sequence heads now available from Ross Operating Valve Co., Detroit, Mich. Known as the "P" adapter, the new pilot section expands the scope of timing by air by making available accurate time delays of up to one minute. The "P" adapter is designed to work in combination with the Ross Graymodel TD head and any body in the Skyline series. In designing this adapter every possible use was anticipated by providing it with an al-



Turn your pressing problem into a *profit operation* with an

C-FRAME STRAIGHTENING PRESS

Accessible, fast, flexible for performing a variety of general-purpose straightening, forcing, bending and forming work. Sizes and capacities for all service needs.

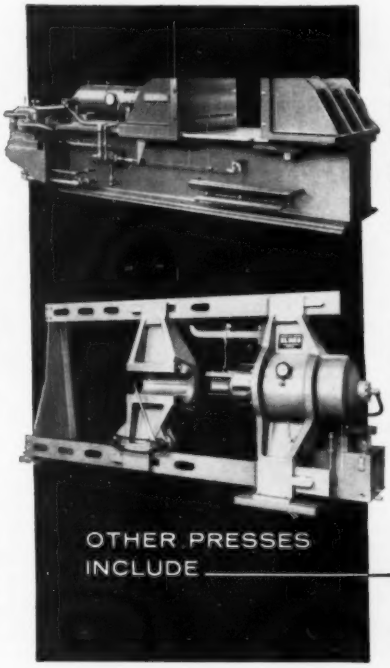
ELMES

"Job-Fitted" HYDRAULIC PRESS

Hundreds of manufacturers have called on Elmes to help solve production problems involving pressure application. It's no secret that Elmes engineering is pre-eminently qualified to provide this profit-making service—to recommend *the right press for the job.*

It will pay *you*, too, to call in Elmes on your pressing problems. Maybe your answer is in one of the many standard Elmes® designs, either "as is" or with simple modification. Or, if your requirements are special, Elmes will develop a "custom-built" press to fit your needs *exactly*. This special-design function has long been an important part of Elmes' service to industry.

In any case, you'll be wise to take advantage of engineering knowledge, skill, and foresight backed by more than 60 years of leadership in specialized hydraulic service. Recommendations and cost estimates promptly supplied. See your Elmes Distributor, or write us direct.



HORIZONTAL BULLDOZER

For heavy bending and forming. Wide range of capacities with optional choice of bed size, stroke and speed to suit individual needs.

INCLINED FORCING PRESS

For forcing heavy wheels, gears, and pulleys on and off shafts, for maintenance work, etc. Capacities from 100 to 1000 tons.

OTHER PRESSES INCLUDE — standard and special designs for drawing and forming, coining, forging, hobbing, powder metal compacting, etc.

Elmes American Steel Foundries
ENGINEERING DIVISION
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METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS

For more data, circle this page number on inquiry card

ternate internal or external pilot supply. Individual pressure can go directly to each of the three working components, or pressure can be supplied in any combination of hookups. A modification available on special order makes it possible to supply pilot air from the valve body, through the "P" adapter to the TD head, if the application makes this desirable.

Circle Item 619 on postcard, page 189

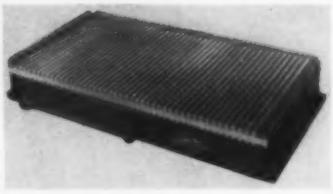
Air-Operated Drill Jig

Bridge type air-operated drill jig designated the "Wedge-lok," one of two styles developed by the N. A. Woodworth Co., Detroit, Mich. Both this and the "Air-lok" style unit incorporate twin air cylinders built into the base casting which actuate the jig posts to raise and lower the bushing plate. All dimensions are identical with Woodworth's style No. 4 "Cone-lok" jig, except the over-all height, the base casting being 1 inch thicker than the hand-operated model. The "Wedge-lok" design includes an internal locking mechanism on each post. Bushing plate remains in a clamped position with the air off. The "Air-lok" design depends upon a constant line pressure to effect clamping. Both styles are equipped with a control valve to adjust the down-stroke speed of the bushing plate.

Circle Item 620 on postcard, page 189

Walker Magnetic Chuck

Magnetic chuck of permanent magnet type with work-holding surface 12 by 24 inches announced by the O. S. Walker Co., Inc., Worcester, Mass. Designated the Walker 1224, it has a larger capacity than any chuck of the same type previously brought out



by this company. The new chuck incorporates ceramic magnets which are claimed to have many times the coercive force of alloy magnets. The bar poles, only 1/4 inch wide, provide uniform holding power over the entire chuck top. The work-holding ability is said to be excellent, even on very thin parts. Secondary external fields are controlled to prevent magnetism from invading the machine table and ways. In the "Off" position, the chuck is completely demagnetized. Like all other chucks in this company's line, the new model is entirely suitable for use on milling and planing machines.

Circle Item 621 on postcard, page 189

Single-Stage Regulator for Low-Pressure Service

Single-stage, inverse type station regulator for low-pressure service, designated the Airco 9900 series, announced by Air Reduction Sales Co., a Division of Air Reduction Co., Inc., New York City. Because of low friction in the internal mechanism and large effective area of the flexible diaphragm used, these regulators provide accurate pressure regulation with practically no fluctuation in delivery pressure.

Circle Item 622 on postcard, page 189

Denison Check Valve for Hydraulic Systems

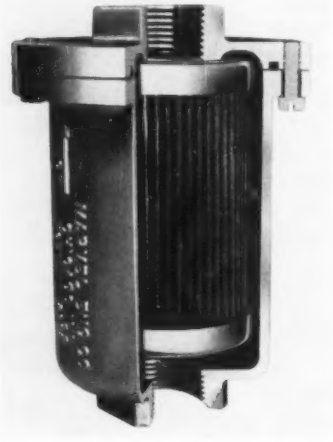
Check valve of series developed by the Denison Engineering Division, American Brake Shoe Co., Columbus, Ohio, for dependable operation in hydraulic systems at pressures up to 5000 psi. This check valve is made in both the sub-plate-mounted and sandwich

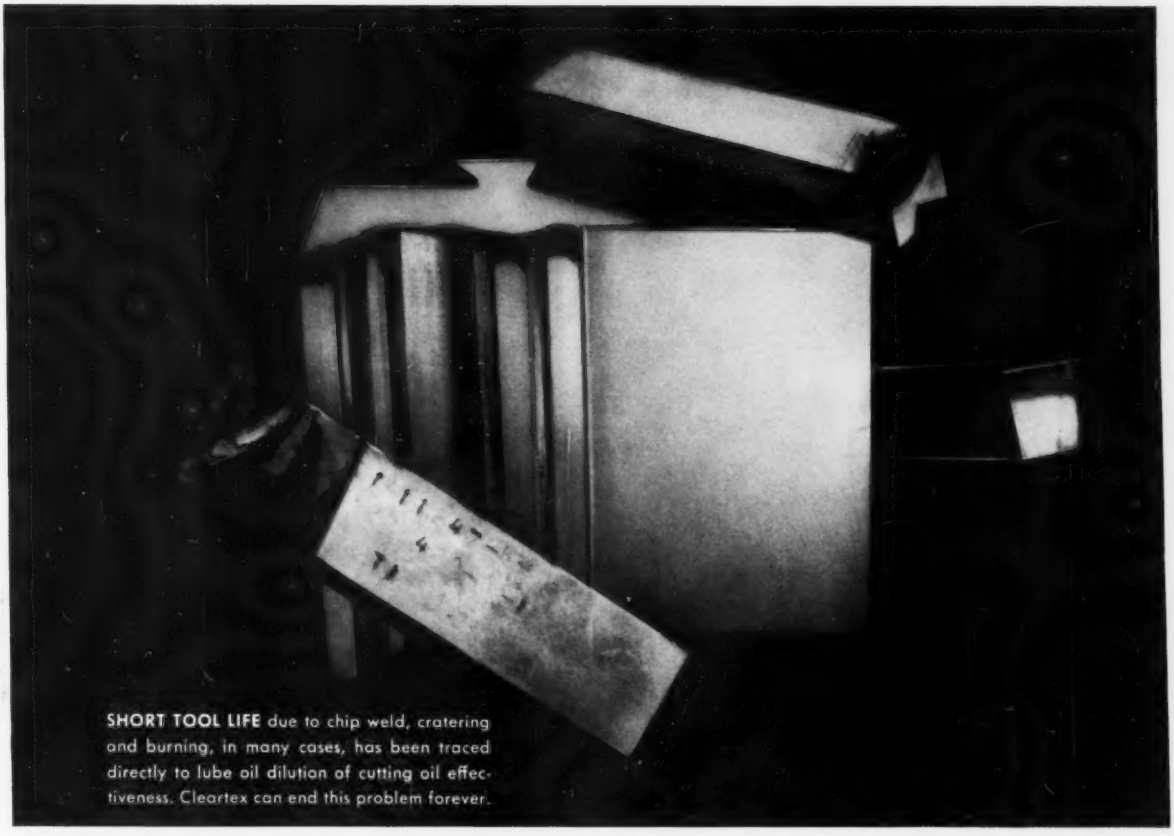
types. Its principal function is to block oil flow in one direction, yet allow free flow of oil in the reverse direction. Both types are available in either 3/4- or 1 1/4-inch sizes.

Circle Item 623 on postcard, page 189

In-Line Filter

Filter for in-line installation to handle hydraulic oil in capacities of from 10 to 25 gallons per minute at very low pressure drop, recently developed by the Marvel Engineering Co., Chicago, Ill. The filter has an over-all length of 6 1/8 inches, head diameter of 4 1/4 inches, case diameter of 3 1/8 inches, and 1-inch NPTF opening at both ends. Filtering





SHORT TOOL LIFE due to chip weld, cratering and burning, in many cases, has been traced directly to lube oil dilution of cutting oil effectiveness. Cleartex can end this problem forever.

It happens in 7 out of 10 automatics!

Diluted cutting oil shortens tool life drastically

Lubricating oil is probably leaking into the cutting oil sumps of your automatic screw machines as you read this. Current research proves that this is happening in 70% of all the automatics in use today! And where it happens, it shortens tool life by as much as 50%—even 70%. On top of this, the cost of extra regrinds, lost production during tool changes, and excessive scrap production is putting a premium on screw machine operation in too many shops.

Look for these symptoms. One sure sign of dilution is the need for frequent refilling of the lube oil sump. If you are using an ordinary lube oil, this dilution will create two additional—and more costly—symptoms: excessive scrap production and frequent regrinds. Now you can eliminate these forever with the

TEXACO CLEARTEX CURE

The exceptional chemical stability and load-carrying ability of Texaco's Cleartex series make them equally suitable for use as cutting oils, lubricants or hydraulic fluids. All you have to do is use them for both cutting *and* lubrication. With Cleartex in *all* your sumps, you'll find cutting oil dilution will stop and screw machine production cost will drop substantially.

Write today for your copy of Texaco's helpful new booklet "Cleartex in Automatic Screw Machines"...and contact your local Texaco Lubrication Engineer for an authoritative survey of your automatics. Just call the nearest of the more than 2,000 Texaco Distributing Plants, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y. Dept. MA-20.

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LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

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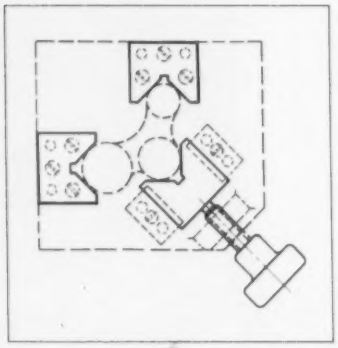
media of Monel-wire cloth are available in mesh sizes from 30 to 100. The cartridge is easily removed for thorough cleaning. There are no throw-away parts to buy or replace.

Circle Item 624 on postcard, page 189



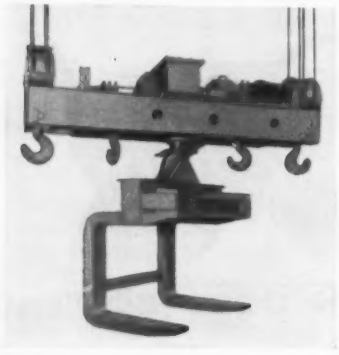
V-Pads for Locating or Clamping Work

V-pads that can be used for locating or clamping announced by Northwestern Tools, Inc., Dayton, Ohio. These pads now available in widths of 1, 2, and 3 inches, with a selection of three thicknesses. They are made of mild steel, not heat-treated, so that they may be drilled, tapped, or counterbored for use as a solid locator or clamping device, as shown.

Circle Item 625 on postcard, page 189

Crane Spreader Beam with Rotating Hook

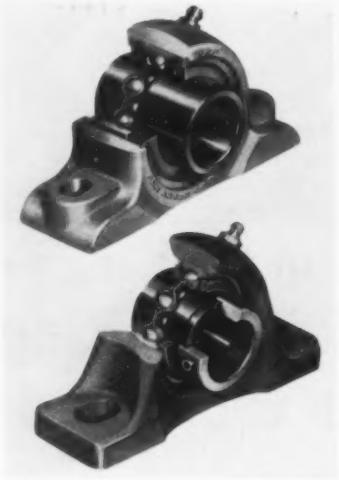
Crane spreader beam with power-driven rotating "C" hook recently completed by the Cleveland Crane & Engineering Co., Wickliffe, Ohio, and delivered to a prominent steel mill for handling ingots and heavy steel slabs. Each spreader beam has five hooks. Center hook may be rotated without limit in either direction by a motor. The two hooks next to the center may be rotated 360 degrees manually. End hooks cannot be turned but may be rocked. All hooks except middle one have a rated capacity of 20 tons. Center hook is used primarily to support a special "C" hook which has a live load capacity of 30 tons.



Circle Item 626 on postcard, page 189

Hoover Pillow-Block Bearing

Economical pillow-block bearing with durable housing of ductile material that resists shock and vibration recently announced by Hoover Ball & Bearing Co., Ann Arbor, Mich. This lightweight Hoover pillow-block bearing and companion flange bearings, also made with ductile housings, are designed to meet need for low-cost, quality-made units to carry light loads at normal speeds. Bearings are made with an extended inner ring, two set-screws for locking the bearing to the shaft, and elongated bolt holes for easy mounting. Other construction features include compensation for normal shaft misalignment, factory lubrication, effective neoprene seals, and a standard grease fitting for service requiring relubrication. Shaft sizes range from 1/2 to 1 3/16 inches.



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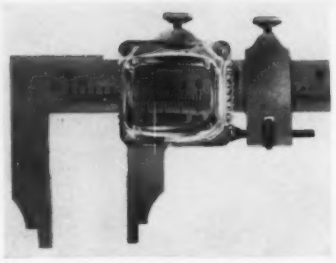


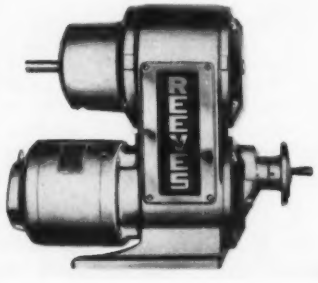
Bausch & Lomb Vernier Magnifier

Vernier magnifier manufactured by Bausch & Lomb Optical Co., Rochester, N. Y. Designed to enable machinists, engineers, toolmakers, and others to read vernier scales easily and with greatly increased accuracy. The clear plastic body of the magnifier is designed to admit available room light. Two permanent Alnico magnets are embedded in the base so that it can be attached to metal scales.

Circle Item 628 on postcard, page 189

Reeves Motor Drive with Mounting for Easy Installation

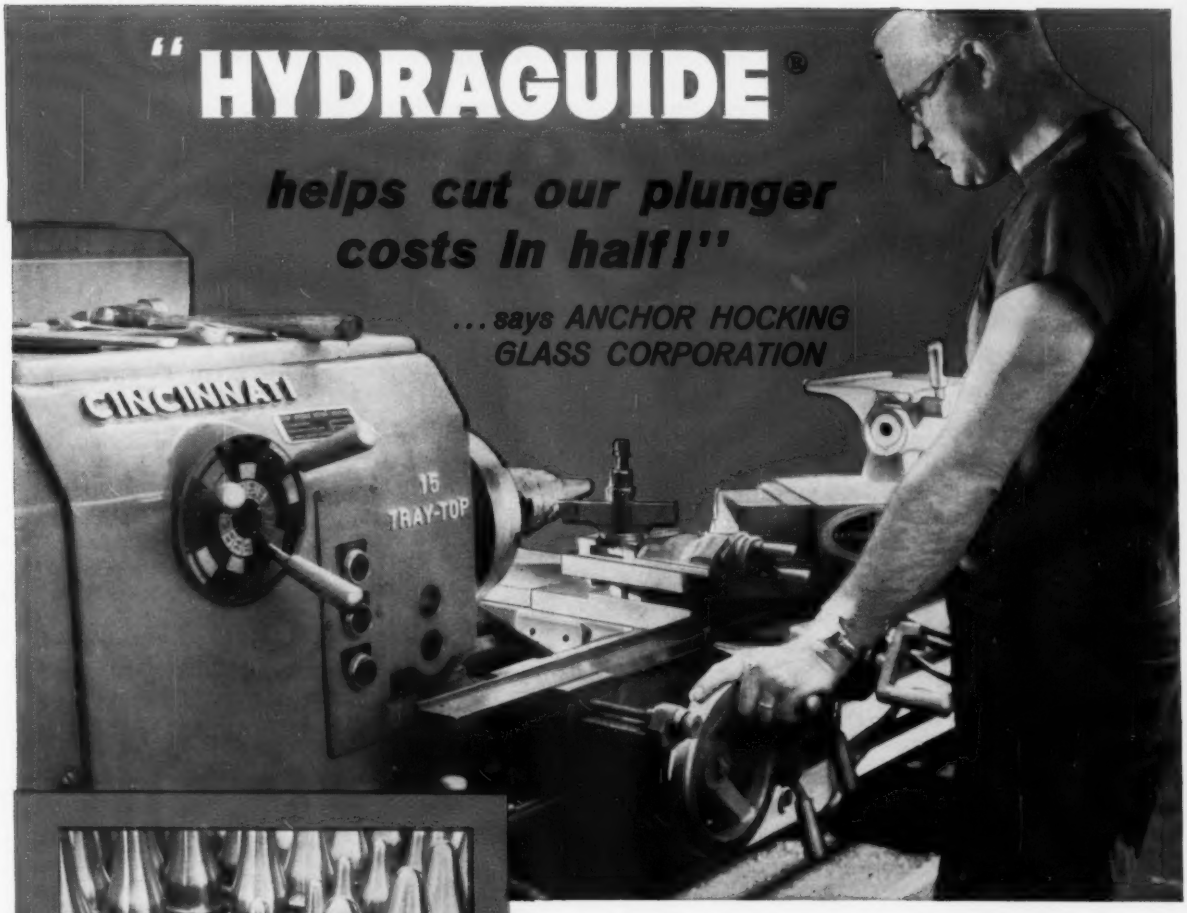
Reeves inverted vertical Vari-Speed Motodrive introduced by the Reeves Pulley Co., Columbus, Ind., a division of Reliance Electric & Engineering Co. This Motodrive has output shaft above the motor, rather than below, as on previous standard units. Added reach resulting from this arrangement permits convenient installation on applications which otherwise would require a special base pad or foundation. Speed ranges for inverted vertical Motodrive vary from a ratio of 2 to 1 through 10 to 1. Minimum speed is 81 rpm



"HYDRAGUIDE®

helps cut our plunger costs in half!"

... says ANCHOR HOCKING GLASS CORPORATION



Various sizes of plungers from ⅛" to 1⅜" tip diameters are machined with .001" tolerance from N-3 steel preforms on the 15" HYDRAGUIDE. Cincinnati HYDRAGUIDE Tracer Lathes are built in 15" and 18" swing sizes and a variety of bed lengths.

"We're now saving more than 50% of our former outside cost in producing glass machine plungers", says James Madden, Superintendent of Anchor Hocking Glass' Winchester (Ind.) plant.

Contributing greatly to this saving is the new 15" CINCINNATI HYDRAGUIDE which handles about 60% of the production. All operations of rough cutting, automatic profiling and polishing are performed on the lathe. In addition to the unvarying contours obtained, the smoothness of HYDRAGUIDE's hydraulic tracer mechanism is also credited with reducing the polishing operations required to produce the 25-30 Micro finish.

Ask your CL&T Dealer to discuss HYDRAGUIDE tracer lathe applications in your plant. Or, write us direct.

Improved Machining Through Research

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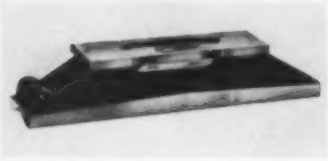
"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

For more data, circle this page number on inquiry card

with a single-stage gear reducer. The top output speed is 4660 rpm. The new mounting is applicable to all Motodrives from 1/4 through 40 hp in all enclosures, and is available with manual, remote, or automatic controls.

Circle Item 629 on postcard, page 189



Wyler High-Precision Block Level

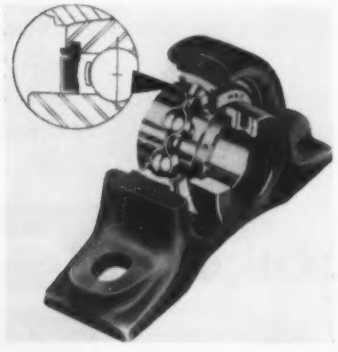
Precision level incorporating several features recently added to line of Swiss-made precision instruments for which Opto-Metric Tools, Inc., New York City, are exclusive distributors. This level has side openings for vertical as well as horizontal observation; bubble tube protection by cover plate which also acts as an insulating grip; and adjustable ground bubble tube. Available in three degrees of sensitivity—2 to 3 seconds, 4 to 6 seconds, and 10 seconds of arc—and four lengths ranging from 6 to 12 inches.

Circle Item 630 on postcard, page 189

Permanently Lubricated Pillow Blocks

Permanently lubricated pillow block of new line introduced by Marlin - Rockwell Corporation, Jamestown, N. Y. The ball bearings used in these pillow blocks are prelubricated at assembly with the proper amount of high-quality grease, thus eliminating the need for any further lubricating. Pillow block permits the bearing to adjust itself to shaft misalignment and still maintain full contact seating of bearing in the housing. It fits standard shaft dimensions and is interchangeable with most other types of pillow-block installations. Positive locking on the shaft is accomplished by a cam-action locking collar which engages an eccentric land on the bearing inner ring. After the collar is positioned and setscrew is tightened on shaft, the locking collar becomes tighter as the shaft rotates. This pillow block is now available in all standard shaft sizes up to 1 15/16 inches.

Circle Item 631 on postcard, page 189



Thriftmaster Heavy-Duty Adjustable Drill Head

Semi-standard, heavy-duty, universal-joint type adjustable drill head announced by Thriftmaster Products Corporation, Lancaster, Pa. Like all Thriftmaster drill heads, this model features full ball-bearing construction as standard. Spindle brackets are precision machined for use with templates. For close center-distance work, the new drill heads are available with spindle bracket assemblies having bronze radial and ball thrust bearings. The close-center assemblies are interchangeable with the ball-bearing assemblies and are also suitable for use with templates.

Circle Item 632 on postcard, page 189

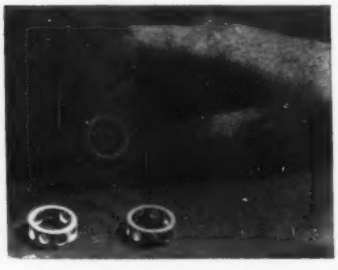
Chuck for Power Impact Wrench

Chuck designed to make an impact wrench into an effective drilling tool now available from Supreme Products Corporation, Chicago, Ill. This chuck will fit all 1/2-inch, square-drive impact tools and holds 1/8- to 1/2-inch drills. It has a keyless gripping action and the ruggedness required to withstand the shock created by impact power tools.

Circle Item 633 on postcard, page 189

Nysorb Ball Retainer for Gyro Rotor Bearings

Nysorb ball retainer developed by the Barden Corporation, Danbury, Conn., to improve lubrication for Gyro rotor bearings in inertial guidance systems, while drastically reducing oil-mass shifts that induce navigational errors. The problem of minimizing these shifts was solved by the Nysorb ball-bearing retainer sintered from



a finely divided nylon powder and then impregnated under vacuum with an instrument oil. This plastic retainer holds sufficient lubricant—20 to 25 per cent of its own weight—in its pores to operate the bearing at high speed for long periods.

Circle Item 634 on postcard, page 189

How a leading automotive manufacturer Snyder-izes for the Soaring Sixties

HOLDS PISTON WEIGHTS ± 2 GRAMS AT 600 PER HOUR

This Snyder transfer machine automatically weighs die cast aluminum pistons and mills them to tolerances of ± 2 grams at double the rate of the previous method. Here's how it turns out 600 parts per hour:

Pistons are transferred bottoms-up to orienting station.

Pistons are oriented in relation to the wristpin hole offset.

Pistons are spun right side up (below at right) while they are advanced to weighing station.

Precise overweight is transmitted by memory system to weigh-mill station during transfer.

A 3¼" milling cutter removes excess with the piston clamped in position.

Gaging station re-weighs pistons to check weight. Deviation from part tolerances stops machine.

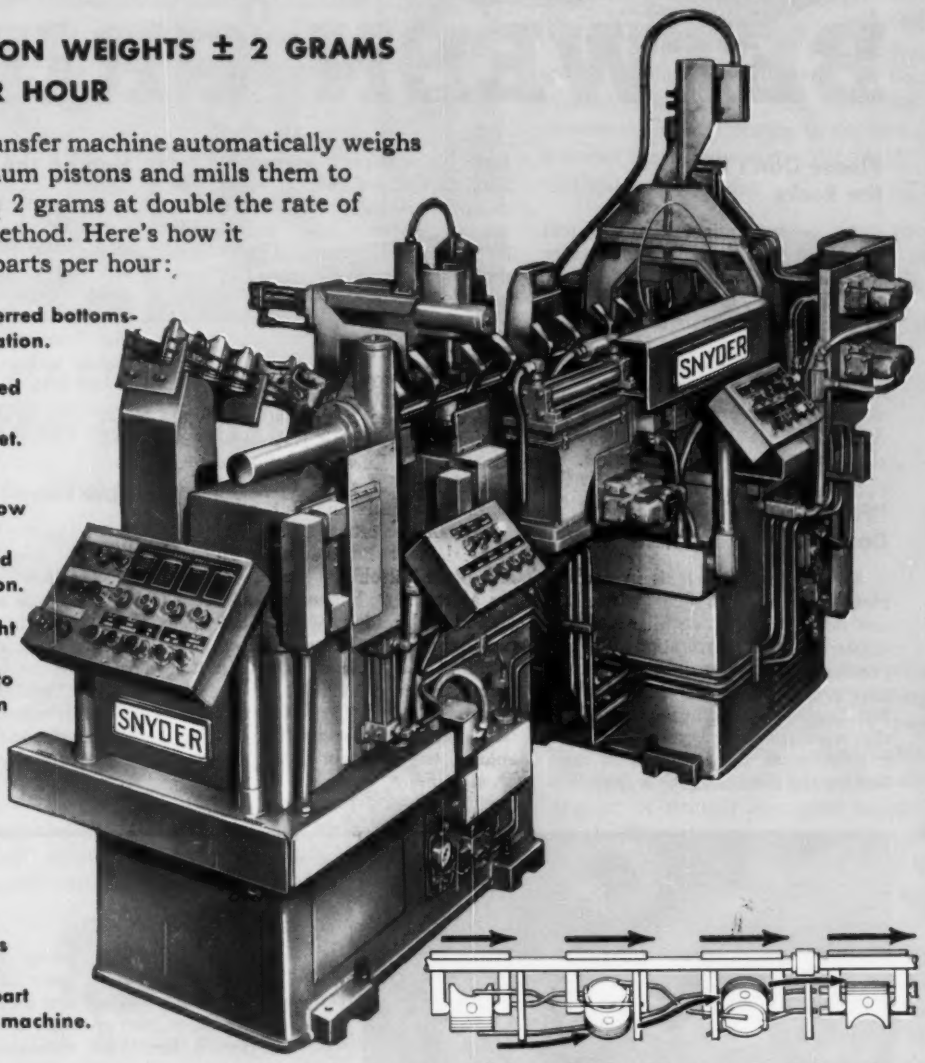


Diagram shows end over end rotation of piston as it passes through spiral rails.

Do your manufacturing cost problems revolve around parts handling, gaging and assembly as well as machining? Ask us to show you the benefits of SNYDER-IZING FOR THE SOARING SIXTIES. For a resume of SNYDER special machines engineered for profit opportunities, send for our new brochure or phone.

SNYDER
CORPORATION
(Formerly Snyder Tool & Engineering Company)
3400 E. LAFAYETTE—DETROIT 7, MICHIGAN
Phone: LO 7-0123

For more data, circle this page number on inquiry card

By E. S. Salichs

BETWEEN GRINDS

Please Don't Pick the Rocks

An outdoor mineral garden will be a feature of the American Society for Metals building now under construction east of Cleveland. Organizations in the metalworking industry are being invited by the Society to participate in the display of native minerals; each specimen and its donor will be properly designated. And ASM is looking for "green thumbs"—the "orecultural" kind.

"Pity the poor Sputnik, Don't know from whatnik."

An orbiting satellite is in a completely gravity-free field where up and down disappear, which fact was apparently the inspiration for the poetic gem quoted above, author anonymous (probably a relative). But Lockheed Missile Systems Division scientists have been working on a solution to the problem of controlling the orientation of a space vehicle. A compact instrument has been developed which would be mounted in the forward part of a satellite where a small hole would let atmospheric gas molecules into the instrument to measure this rock 'n roll, and perhaps to actuate a controlling system.

Niobium Nevermore

Back in the early 1800's, some confusion in naming Element 41 in America and Europe resulted in two names for the same thing—columbium and niobium. But now the American Institute of Mining, Metallurgical, and Petroleum Engineers has placed itself on record that as far as its 30,000 members are concerned, columbium will be the official name. The reason action was taken at this time is that with the metal under discussion playing an increasingly important role in high-temperature metals and reactor technology, the need for a single name became more necessary.

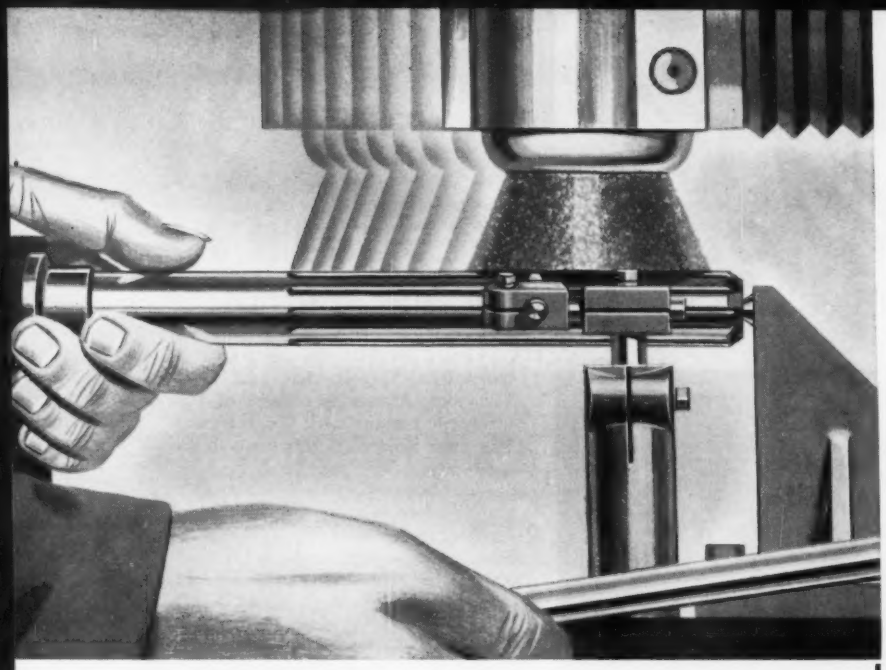
Hop on the Con

A reversible, man-carrying conveyor belt is being used instead of an elevator to whisk coal miners in and out of the Johnstown Coal & Coke Corporation mine, according to *Industrial Research Newsletter*. The "manveyor" runs down a 20-degree incline, making a total drop of 97 feet. Like skiers on a snow slope, the miners can stand, sit, or lie down during the three-minute ride.

How Deep is the Scratch

A telescope-like instrument, developed by Boeing Airplane Co. engineers, now measures depth of scratches on surface of metals. "A beam of light is shone into scratch at calculated angle. The instrument measures the length of the resulting shadow, makes trigonometrical calculations relating shadow length and light angle, and gives scratch depth," to quote *Industrial Research Newsletter*.

HOOP-LA—Attractive Shirley Williamson is seen here modeling a pair of earrings to match the three-pointed star on the Mercedes-Benz roadster, part of which is also shown in the picture. Sports car enthusiasts love their automobiles and say they bring back the joy of motoring. And, according to the Studebaker-Packard Corporation, they go to various lengths to prove their enthusiasm. The girls design jackets with crests on them, fashion costume jewelry carrying out a theme, knit socks bearing the model number, and so on. Men, how about sporting a snappy hub cap as head covering?



OLIVER "ACE" TOOL AND CUTTER GRINDER

Traverses the wheel—not the work!

You can grind tools and cutters more accurately with the Oliver "ACE" because the wheel is brought to the work, reversing the usual process. Abrasive dirt and grit cannot cause wear because the cross carriage is not in motion. The horizontal ram which supports the grinding head is fully enclosed—sealed against dust and dirt. Further accuracy is assured because the wheel is trued by a stationary diamond which provides a fixed grinding line. It is not necessary to reset the cutter to compensate for wheel wear.

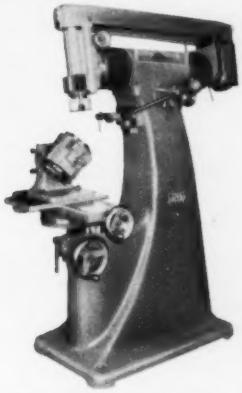
The "ACE" is a tool and cutter grinder designed expressly for tool grinding—not a general purpose machine adapted to tool room work. It is simple to set up. All angles are obtained by direct reading. Operators stand in a natural position with the control lever in easy reach and the work in direct view.

Face mills, reamers, end mills, staggered tooth cutters, slab mills, spot facers—all cutters straight or spiral—are quickly, easily and economically sharpened with the Oliver "ACE". Both standard and heavy duty models are extensively used for sharpening carbide-tipped circular wood saws used in both woodworking and metalworking.

Write today for complete information. We'd appreciate the opportunity of sending a quotation.

HOW TO REDUCE YOUR CUTTING TOOL COSTS

Three elements are absolutely necessary if there is to be a substantial reduction in cutting tool costs—the right tool, the right geometry of grind on that tool, and the right machine to produce the grind. There are various machines which will always be most suitable for specific applications. However, for the average cutter grinder jobs, Oliver has pioneered a new approach to the problem with the introduction of the "ACE" tool and cutter grinder.



The Heavy Duty "ACE"

The cost savings are attractive with respect to both setup time and grinding time. Setup usually consists of two simple "direct-reading" adjustments. The first setting is made to produce the angular or straight line grind requirement. The second setting consists of tilting the grinding wheel spindle to produce the proper clearance—all extremely simple.

Grinding time is reduced considerably because tool travel is eliminated in most cases. Thus the time consists wholly of bringing the grinding wheel on and off the cutting tool. This compares extremely favorably with competitive grinding procedures.

This combination of easy setup and rapid grinding is found only on the economically priced Oliver "ACE" tool and cutter grinder.

There are two versions of the "ACE": the standard, which is suitable for high speed and light duty carbide grinding, and the heavy duty model which is designed for grinding tungsten carbide cutters and tools in all of their many forms.

OLIVER of ADRIAN

1410 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL
FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES

News OF THE INDUSTRY

California and Texas

TOPP INDUSTRIES, INC., of Los Angeles, Calif., has announced the sale of Heli-Coil Corporation, a wholly-owned subsidiary with headquarters in Danbury, Conn. The subsidiary was sold to an eastern group headed by W. C. Langley of New York City. Proceeds from the sale will be used for the expansion of the company's industrial controls division and to finance the rapidly accelerating production of United States Semi-conductor Corporation, Inc. of Phoenix, Ariz., which the company currently is negotiating to purchase.

JOSEPH M. TILL has been named production control manager for the Montebello plant of Western Design, a division of U. S. Industries, Inc., Los Angeles, Calif.

JAMES M. STONE has been named assistant general manager of the DES MOINES DIVISION of Solar Aircraft Co., San Diego, Calif.

The CLECO DIVISION, Reed Roller Bit Co., Houston, Texas, has announced two changes in the Cleco sales organization. E. W. CLAYTON, formerly sales development manager of Cleco, has been promoted to the position of sales manager of the Cleco Division. T. E. DONOHUE, former sales manager, has been named general manager of the Cleco Pneumatic Co. of Canada, Ltd., which markets Cleco products in Canada. The Canadian firm is located at 927 Millwood Road, Leaside, Toronto, Canada.

District of Columbia

JAMES H. SANDS, executive vice-president, ECLIPSE FUEL ENGINEERING CO., Rockford, Ill., today was named adviser to the director of the Metalworking Equipment Division, Business and Defense Services Administration, U. S. Department of Commerce. Announcement of the appointment was made by BDSA Administrator H. B. McCoy, as Mr. Sands began a six-month tour of duty, without compensation, on loan from his company under an arrangement by which industry makes available the services of key personnel for temporary assignment. This service also permits indoctrination in the work of the National Defense Executive Reserve. The Reserve would staff the operation of an emergency production agency in event of hostilities involving this country. Mr. Sands, who is also a member of the board of directors of the Industrial Heating Equipment Association, Inc., has been active in the industrial heating industry for the past fifteen years.

James H. Sands, adviser to director, Metalworking Equipment Division, Business and Defense Services Administration

Indiana and Ohio

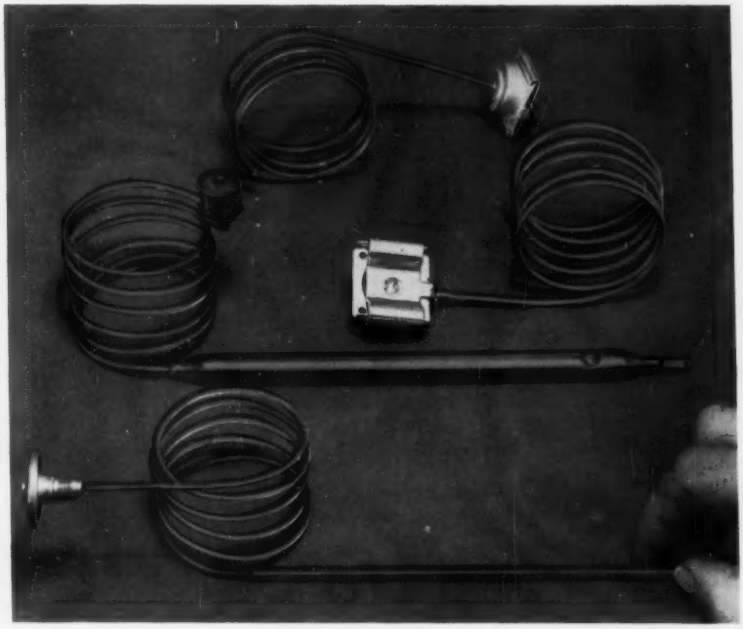
NATIONAL AUTOMATIC TOOL CO., INC., Richmond, Ind., announced that the company has purchased the JES-CAL CO., Fraser, Mich. Directors and officers of Natco's wholly owned subsidiary are H. W. BOCKHOFF, chairman of the board; N. M. FORSYTHE, president; G. P. SMITH, vice-president and general manager; R. C. SCHUERMAN, treasurer; and R. C. GILDENHAR, secretary and assistant treasurer. A. B. MCCREA and S. F. HUNT are also directors. With the exception of Smith all are Natco executives. F. J. JESCHKE and G. M. CALVERT, former co-owners of Jes-Cal, will remain with the company and have been made vice-presidents.

CHARLES L. CATT has been named manager of production and material control for ATKINS SAW DIVISION, Borg-Warner Corporation, Indianapolis, Ind. Mr. Catt will fill the position vacated by the promotion of CARL INGELS to manager of manufacturing.

JAMES P. GILL, president of the VANADIUM-ALLOYS STEEL CO., Latrobe, Pa., announced the appointment of ARCHIE L. SPRATT as director of research and engineering for the METAL FORMING CORPORATION Division in Elkhart, Ind., effective February 1, 1959. The announcement by Mr. Gill was made jointly with THOMAS F. COLLINS, president of the Metal Forming Corporation, which became a fully owned division of Vanadium-Alloys Steel Co. early last summer. Mr. Spratt will be in charge of all technical problems relating to MEFCO's manufacturing procedures and products.

SIDNEY MACHINE TOOL CO., Sidney, Ohio, one of the nation's oldest lathe builders, has appointed RUDEL MACHINERY CO., INC., one of the three largest distributors of machine tools in the United States, as distributors for its entire line for all of New England and northern New York. All New England states, with the exception of Connecticut, will be handled out of Rudel's Boston office in the Statler Building. DONALD L. STEVENS, sales manager of that office, will be in charge. Connecticut representation will be under the supervision of R. S. GRANFIELD, branch manager since 1942 of Rudel's West Hartford office at 7 South Main St. In northern New York, representation will be handled by the C. H. BRIGGS DIVISION of Rudel Machinery Co. C. H. Briggs, Rudel vice-president and district sales manager, will be in direct charge of Sidney representation in the area, assisted by JOHN E. HUYETT, Buffalo branch manager, and six machine tool sales engineers

10 TO 15 NEW JOBS a week, each a different application, require a continuous program of evaluating the properties of metals and fabricating costs at Robertshaw-Bridgeport.



In making bellows (left) and temperature sensors (above) to meet ever-changing needs of control, appliance, and industrial equipment manufacturers, Bridgeport Thermostat Div., Robertshaw-Fulton Controls Co., Milford, Conn., averages 10 to 15 new problems a week. Specifications vary widely in dimensions and physical characteristics. Dependable performance over long periods of uninterrupted service is vital—yet costs must be rigidly controlled.

So for quality with maximum economy in fabrication, materials must be matched precisely to the needs of each job. And in this, Robertshaw-Bridgeport looks to its suppliers for creative technical services. For many years, The American Brass Company specialists have been helping to select the correct alloys in phosphor bronze or brass and to meet fabrication problems in the making of bellows—to apply economically precision-made capillary tubing and other small-diameter copper tube in sensor assemblies. Through such services, The American Brass Company is constantly helping metal fabricators across the nation control quality while keeping costs down.

ARE you caught between cost reduction and quality control? Find out if you are buying metal properties you don't need. An Anaconda specialist may be able to suggest a lower cost alloy that fits the requirements of your job more closely. Or he may find that an adjustment of temper or a change in your fabrication methods can cut your costs. The services of Anaconda specialists are available through your American Brass representative. Call him in today, or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5857

ANACONDA®

COPPER BRASS BRONZE NICKEL SILVER MILL PRODUCTS

Made by The American Brass Company

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operating out of the Syracuse office. The C. H. Briggs Division of Rudel Machinery Co. is located at 114 South Warren St., the Buffalo branch, at 1807 Elmwood Ave.

The BUNTING BRASS AND BRONZE Co., Toledo, Ohio, has announced the following appointments: ROBERT F. HAWKINS represents the firm in the southwestern area, handling sales engineering operations in Texas, Oklahoma, Louisiana, Mississippi, and Arkansas, with headquarters in Dallas, Tex.; GEORGE S. MOUNTFORD of Westlake, Ohio, services northern Ohio, western Pennsylvania, and West Virginia, operating from Westlake; JOSEPH T. WEBER joins the Chicago district sales office, serving accounts throughout Wisconsin and Minnesota, with headquarters in Milwaukee; JAMES N. GUTHRIE is assisting JAMES R. SCHULTZ, senior sales engineer, in the Philadelphia office.

MONARCH MACHINE TOOL CO., Sidney, Ohio, announces that ALFRED SHERMAN, manufacturing vice-president, assumes the office of consulting vice-president until his retirement in June. Newly elected manufacturing vice-president is FRANK GRAZIANO, formerly assistant manufacturing vice-president and member of the board of directors. New general superintendent is LOUIS KRITZER.

ERIE TOOL & SUPPLY CO., Toledo, Ohio, has been appointed by the METALLURGICAL PRODUCTS DEPARTMENT of General Electric Co. as an authorized Carboloy distributor in the northern Ohio area. The new distributor's address is 304 N. Westwood, Toledo.

JOSEPH T. RYERSON & SON, INC., Cleveland, Ohio, announced that it has added Reynolds aluminum to the stocks carried at its Cleveland plant. Heading aluminum sales at Cleveland is THOMAS A. RALCE.

Illinois and Wisconsin

CLEARING, division of U. S. Industries, Inc., Chicago, Ill., announces the appointment of WING & JABAAY as their local dealer in Western Michigan for open-back inclinable and horning presses up to 200 tons capacity. Clearing has also appointed Four States Machinery Co. to be their local dealer for mechanical presses up to 200 tons capacity.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., nation-wide steel distributing subsidiary of INLAND STEEL Co., has entered Texas for the first time by acquiring the Dallas and Houston plants and stocks of Vinson Steel and Aluminum Co., Dallas, Tex., steel and aluminum distributor in that area.

C. M. SHEPSTONE has been appointed Rockford sales representative for the INDUSTRIAL PRODUCTS DIVISION, WARNER ELECTRIC BRAKE & CLUTCH CO., Beloit, Wis. Mr. Shepstone will make his headquarters at 5105 Highcrest Road, Rockford, Ill., and will supervise the firm's sales and service activities in northern and central Illinois, Iowa, and Nebraska.

LINDBERG ENGINEERING CO., Chicago., Ill., has announced the completion of a national sales agreement with UPTON ELECTRIC FURNACE CO., Roseville, Mich.

CLEARING, division of U. S. Industries, Inc., Chicago, Ill., announces the appointment of WILLIAM K. STAMETS CO. to be its local dealer for the Torc-Pac line of open-back inclinable presses.

GISHOLT MACHINE CO., Madison, Wis., has recently acquired the distribution rights in the United States of America for the CRI-DAN semi-automatic, single-point threading lathe.

THOMAS F. SCANNEL has been appointed vice-president—general sales manager of the FALK CORPORATION, Milwaukee, Wis.

Michigan

FEDERAL-MOGUL-BOWER BEARINGS, INC., Detroit, Mich., has announced some major realignments of responsibilities in the company's management. R. S. STRICKLAND, who has been vice-president—sales and marketing, will head a new grouping of the company's bearing divisions (Bower, Federal-Mogul, and Bearings Co. of America) with the title of vice-president—general manager, Bearing Divisions. R. E. KLARE, formerly general manager of the Federal-Mogul Division, has been promoted to a new position of vice-president—operations, Bearing Divisions. R. W. MUZZY, formerly executive assistant to Mr. Klare, has been made general manager of the Federal-Mogul Division. F. E. HALDERMAN, general manager of the Bower Division, and J. A. MCCARTHY, general manager of the Bearings Co. of America Division, will continue as general managers of these operations. The sales managers of these divisions, S. E. DAVIDSON for Bower, H. W. LUDWIG for Bearings Company of America, and T. J. MARSHALL for Federal-Mogul, will report directly to Mr. Strickland.

METALLURGICAL PRODUCTS DEPARTMENT of General Electric Co., Detroit, Mich., announces two appointments: RAY F. PARKER, formerly manager of cutting tool sales, takes the newly created position of manager of carbide sales, and GRANT A. MORRISON, as manager of carbide application engineering, heads a new function. In the carbide application engineering group will be E. J. WELLER, E. L. BOERSIG, BEN E. STORRS, and GERALD NALON. The two functions will report to GEORGE M. HARTLEY, marketing manager.

MITCHELL P. KARTALIA, manager of SQUARE D CO., Detroit, Mich., Marketing Division, has been elected a vice-president. Mr. Kartalia is responsible for all programs within the total marketing concept, including distributor relations, field office operations, national advertising, market research, product development liaison, and export activities.

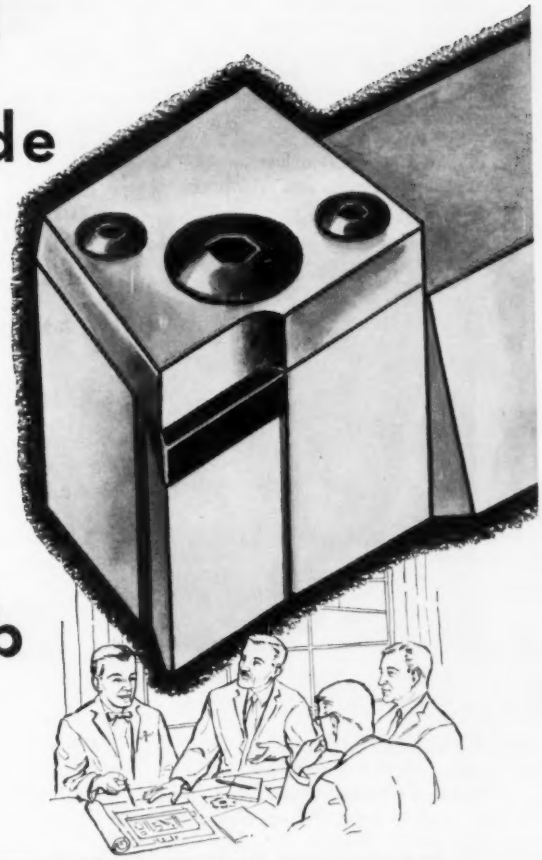
HARRY E. GRAVLIN, JR., of Dearborn, Mich., has joined HAMILTON STANDARD, division of United Aircraft Corporation, Windsor Locks, Conn., as production manager. In this newly established post he will be responsible for factory, purchasing, and production product operations.

The HANCHETT MFG. CO., of Big Rapids, Mich., and Portland, Ore., announces the construction of a new branch office, factory, and warehouse located at Fifth Ave. South and Thirty-First St., Birmingham, Ala.

HOOVER BALL AND BEARING CO., Ann Arbor, Mich., announced that purchase of STROM STEEL BALL CO. of Erwin, Tenn., has been consummated and negotiations completed to acquire COOLIDGE CORPORATION of Middletown, Ohio.

MARIAN SZCZEPANSKI was appointed director of research of the WHEEL TRUEING TOOL CO., Detroit, Mich. Mr. Szczepanski will be responsible for research leading to im-

Production Men ENGINEER the Carbide in the Tools... for Best on-the-job Results

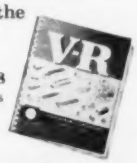


PRODUCTION MEN KNOW cutting problems better than anyone else. That's why all V-R Carbides are engineered by production men to handle thousands of production applications. This fund of cutting know-how goes to work for you whenever you use V-R Carbides and cutting tools.

HERE'S THE POINT. You wouldn't specify 1020 steel for a job requiring a nickel-chrome 3140. Similarly, the proper Carbide grade is determined by the specific cutting problem. Give us the full details on your applications — V-R engineers will work with you to fit the right Carbide to the job.

COMPLETE LINE OF CARBIDE, CERAMIC AND TANTUNG® CAST ALLOY CUTTING TOOLS.

Send for new Catalog VR-58 for complete details



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PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

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provement of present Wheel Trueing processes, as well as new-product process development.

New England

FAFNIR BEARING CO., New Britain, Conn., has announced changes in several top executive positions. CHARLES F. STANLEY, vice-president of Fafnir Bearing Co., New Britain, Conn., retired December 31, ending a forty-year sales career with the company. Mr. Stanley joined Fafnir in 1915, and in 1940 was elected to the board of directors. During 1952 Mr. Stanley served as director of the General Components Division of the National Production Authority in

Robert W. Powell, vice-president—sales, Fafnir Bearing Co.

Washington. Mr. Stanley will continue to serve Fafnir as a director. KEITH T. MIDDLETON and RICHARD F. COOPER were elected administrative vice-presidents. Mr. Middleton will retain the office of secretary. Both will assist president CLARENCE G. ROSENSWEIG in administration of the company. Other changes were as follows: general sales manager ROBERT W. POWELL was elected vice-president—sales; he succeeds Mr. Stanley. General works manager FRANKLIN S. ATWATER was made vice-president—manufacturing, succeeding Mr. Cooper; and assistant treasurer RANDOLPH B. ROBERT was elected treasurer, succeeding Mr. Middleton in this office.

Three promotions in the field sales force of PRATT & WHITNEY CO., INC., West Hartford, Conn., are announced: GEORGE A. CRITTENDEN has been named district sales manager of the New York office. He will head all cutting tool and gage sales activities in the New York City territory. VICTOR H. G. WADLUND, a member of the sales staff of the Philadelphia office, has been named district manager of that office to succeed Crittenden. DONALD A. HEATON has been named district sales manager in charge of all cutting tool and gage sales activities in the Philadelphia territory.

FRANK U. HAYES has resigned as vice-president and assistant general manager of the BULLARD CO., Bridgeport, Conn. In January, he will assume his new duties as president and general manager of SPERRY PRODUCTS, INC., Danbury, Conn.

THE TORRINGTON CO., Torrington, Conn., has elected WALTER C. THOMPSON chairman of the board. MILTON E. BERGLUND was elected president, succeeding Mr. Thompson, and RODNEY T. DUNLAP was elected executive vice-president.

R. M. GORDON has been named vice-president for sales of the MILFORD RIVET & MACHINE CO., Milford, Conn. He will continue to be located at the home office in Milford.

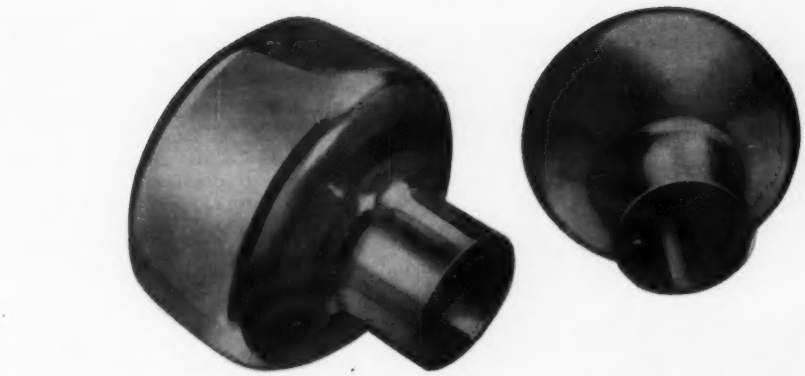
L. S. STARRETT CO., Athol, Mass., announces a new Gage Division with manufacturing, engineering, and sales facilities to design and build complete special gaging equipment. The new division will offer counsel and advice on special problems and will manufacture "tailor made" gages to meet the requirements of any company, particularly those not having the facilities for such work. Inquiries may be sent to the L. S. Starrett Co. in Athol marked for the attention of the Special Gage Division.

Esmonde J. Bushey, works manager, Athol Division, Union Twist Drill Co.

ESMONDE J. BUSHEY has been named works manager of the ATHOL DIVISION, Union Twist Drill Co., Athol, Mass. He will succeed GEORGE W. GROVER, SR., who retired at the end of 1958 after thirty-nine years of service with the company. He came to the Union Twist Drill Co. in 1947 as a design engineer. Subsequently he became chief engineer and in early 1958 was appointed assistant works manager.

NORTON CO., Worcester, Mass., has elected DONALD L. PRICE a vice-president. ROBERT CUSHMAN, manager of marketing services since January 1958, succeeds Mr. Price as sales manager, Grinding Wheels. HARRY G. BRUSTLIN, West Coast district manager in Los Angeles, will return to the Worcester, Mass., main office of the company to succeed Mr. Cushman. SIDNEY B. WETHERHEAD has been appointed Norton Co.'s Pacific Coast district manager with

(Left) Donald L. Price, vice-president of Norton Co., and (right) Robert Cushman, sales manager, Grinding Wheels, Norton Co.



4 OF THE MANY STYLES OF THE ONE-PIECE SEAMLESS DOOR KNOBS FABRICATED FROM RUGGED REVERE BRASS STRIP.

REVERE BRASS STRIP Stands the Gaff!

The one-piece door knobs shown are drawn from a single blank of Revere Brass Strip, presenting an attractively smooth, unbroken surface without the need for seams or welds.

Because they are made by a unique procedure the manufacturer tells us that the brass must stand up under mighty rugged going, and that to produce the quality knobs they do, at an economical production level, the brass they use must have:

1. *Uniformity of gauge.*
2. *Absence of any sign of fracture or crimping when drawn.*
3. *Consistently correct grain structure to insure a smooth, flaw-free surface on the finished knobs.*

The manufacturer also tells us that Revere Brass Strip has been filling that bill, with utmost satisfaction, for some time.

Revere Brass Strip may be able to help *you* make a better product at less cost. You'll never know until you talk it over with one of our TA's (Technical Advisor). There's no obligation, of course. And such a discussion could save you a substantial sum of money. Such has been the case many, many times.

COPPER ★ BRASS ★ 18 01 ★ REVERE ★ ALUMINUM

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

For more data, circle this page number on inquiry card

headquarters at Los Angeles. WILFRED R. OGG, Chicago district manager of the company's Grinding Machine Division since 1951, becomes manager of distributor sales for the Division. CALVIN K. KIRK will succeed Mr. Ogg as Chicago district manager. THOMAS D. BUSHMAN has succeeded Mr. Kirk as product research engineer.

George S. Chiaramonte, sales manager, Cogsdill Twist Drill and Threadwell Tap & Die Divisions of the Sheffield Corporation

GEORGE S. CHIARAMONTE has been appointed sales manager of the COGSDILL TWIST DRILL and THREADWELL TAP & DIE DIVISIONS, Greenfield, Mass., of the SHEFFIELD CORPORATION, Dayton, Ohio. Mr. Chiaramonte is a director of Gabb Special Products, Inc., Windsor Locks, Conn. He is well known in industrial distributor circles and is a member of the Educational Aids Committee of the American Supply and Machinery Association.

FELLOWS GEAR SHAPER CO., Springfield, Vt., has arranged to manufacture and market the entire line of gear hobbing machines and worm milling machines made by Hermann Pfauter, Hobbing Machine Works, Ludwigsburg, Germany. Work will start at once on one of these gear hobbing machines and Fellows will act as agent for the remainder of the Pfauter line until facilities for manufacturing in this country are established. Fellows-Pfauter gear hobbing machines manufactured in this country will conform to American Standards and will be serviced by Fellows' nationwide service organization.

HUGH G. MONTGOMERY has been appointed area sales manager for Madison-Relco Tool Co., Providence, R. I. Mr. Montgomery, who lives on Haynes Road, Avon, Conn., will be responsible for the sale of all Madison-Relco tools in the state of Connecticut.

SPLIT BALLBEARING, Lebanon, N. H., division of Miniature Precision Bearings, Inc., Keene, N. H., has opened a new plant. The facility, constructed at Lebanon, will enable Split Ballbearing to manufacture bearings for many new applications in aviation, farm machinery, precision instruments, and other fields.

New York and New Jersey

UNION CARBIDE CORPORATION, New York City, today announced a new name for its metals division. Electro Metallurgical Co. becomes Union Carbide Metals Co. This change of name is another step in the program initiated by Union Carbide Corporation in 1957 designed to identify all of its divisions more closely with the parent corporation. In 1957, Union Carbide Corporation shortened its name from Union Carbide and Carbon Corporation and created the Union Carbide hexagon symbol. The company will continue to produce ferroalloys, metals, metal chemicals, and other metallurgical products under the long-used "Electromet" trade-mark and other well-known brand names.

R. E. LENHARD, executive vice-president of Air Reduction Sales Co., New York City, the industrial gases and welding products division of Air Reduction Co., Inc., New York City, has been appointed president of that division. He succeeds J. H. HUMBERSTONE, who, as vice-president of Air Reduction Co., Inc., will devote full time to corporation affairs. DR. ALBERT MULLER, assistant to the president of Air Reduction Sales Co., the industrial gases and welding products division of Air Reduction Co., Inc., has been appointed vice-president of that division. Before joining Air Reduction in 1946, Dr. Muller was with the National Academy of Sciences, War Metallurgy Committee, Washington, D. C.

BROOK-ANCO CORPORATION, Rochester, N. Y., was recently formed as a consolidation of Anderson-Newton Sales Engineering Co. and Victor Brook & Son. The merger of these two sales engineering concerns makes possible a better coverage of upstate New York for their principals who are makers of gages, specialty tools, and machine tools.

THE NEW JERSEY ZINC CO., New York City, has extended its sales representation by establishing a new sales district for the West Coast area. JOHN S. COLLBRAN, JR., will serve as Pacific district manager, with headquarters at Los Angeles. JAMES P. SHERIDAN has been appointed Western District manager, Chicago.

ARWOOD PRECISION CASTING CORPORATION, New York City, has named HARRY MATTHIESON to the newly created post of vice-president of process engineering. Mr. Matthieson had been plant manager of Arwood's Brooklyn plant. JOSEPH J.

(Left) Dr. A. Muller, vice-president, Air Reduction Sales Co. and (right) R. E. Lenhard, president, Air Reduction Sales Co., Air Reduction Co., Inc. division

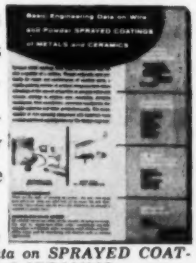
A message to the designers
and producers of industrial equipment

HOW AN ENGINEER CAN BECOME HIS COMPANY'S BEST SALESMAN

Many of the most important users of industrial equip ment are users of metallizing. More than 6000 of them today – a list that reads like a Bluebook of American industry. They use this modern process to maintain – *and improve* – the performance of equipment they buy. They have found through long experience that worn areas of machine parts can be made to give double and triple the ordinary service life by metallizing them with materials superior to the base metal. In many cases, new equipment is disassembled and critical parts metallized *before* they are used. These companies do this at very low cost.

You can provide the same advantages on a production basis at a fraction of that cost. Many *manufacturers* of industrial equipment are doing just that because it gives them a competitive sales point that they can use to advantage. One of these days an alert competitor of yours may get the same idea – *and the business.*

It will cost you nothing to find out if metallizing can improve the performance of your product, at low cost; give your company an important sales advantage. A comprehensive Engineering Data Bulletin on metallizing is yours for the asking – or better yet, a conference with an experienced, full-time, trained Metco field engineer in your territory who stands ready to advise users of metallizing as well as prospective users, how this low-cost process can go to work for them. Maybe it can go to work – profitably – for your company. Telephone, wire or write.



Free Bulletin No. 136
Basic Engineering Data on SPRAYED COATINGS of METALS and CERAMICS

METCO®

Metallizing Engineering Co., Inc.
1131 Prospect Ave., Westbury, L. I., New York • cable: METCO
In Great Britain: Telephone: EDGEWOOD 4-1300
METALLIZING EQUIPMENT COMPANY, LTD.– Chobham near Woking, England

For more data, circle this page number on inquiry card

SHIEL, formerly assistant plant manager at Brooklyn, has been promoted to plant manager.

OAKITE PRODUCTS, INC., New York City, announces that J. D. RODGERS and R. A. NEDERMAN have been named technical service representatives of the company in Houston and Kansas City, respectively.

AMERICAN COLDSET CORPORATION, Tool & Wheel Division, Teterboro, N. J., announces the appointment of EUGENE L. BROWN as a sales representative. Mr. Brown will represent the firm in northern Alabama, headquarters being at 4245 Morris Ave., Birmingham 12. Appointment of HAINES TOOL CO. as an authorized sales representative with headquarters at 6536 Carnegie Ave., Cleveland 13, Ohio, was also announced. E. B. NARBER will handle sales in Florida, with headquarters at 279 Atlantic Ave., Miami. New York City, Long Island, Staten Island, and southeastern New York state up to Poughkeepsie will be covered by G. R. DAVENPORT, his headquarters being at 5 Tudor Place, Hartsdale, N. Y. Sales in northern Ohio will be handled by C. R. GILMORE, with headquarters at 14512 Fairlawn Ave., Cleveland 11. BUCHEIMER TOOL SALES CO. will service the state of Maryland and parts of eastern Pennsylvania, with headquarters at 24 W. Alleghany Ave., Towson, Md.

Pennsylvania

UNITED STATES STEEL CORPORATION, Pittsburgh, Pa., announces the appointments of LOUIS W. MASON as sales manager—eastern area and JAMES G. MORRISON as sales manager—central area of the National Tube Division of the corporation. Mr. Mason will make his headquarters in New York, with supervision of National Tube's district sales offices in Boston, New York, Philadelphia, and Atlanta. Mr. Morrison, who succeeds Mr Mason as central sales manager, will be located in Chicago and will be responsible for supervising National Tube's sales offices in Chicago, Pittsburgh, Detroit, and St. Louis.

SKF INDUSTRIES, INC., Philadelphia, Pa., announces the appointment of F. HAROLD WILLIAMS as general manager of the newly created Hornell Division. The new division was created and designed to concentrate both manufacturing and marketing responsibilities within a single organization. The Hornell, N. Y., plant will continue its operations under plant manager H. R. FILLMORE as an operating unit of the new division.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., has added a new warehouse in Erie, Pa., to its growing number of warehouses. The new facility is located at 1134 Payne Ave., Erie, Pa. Operating as a subbranch of the Cleveland warehouse, the Erie warehouse will serve Crucible customers in northwestern Pennsylvania, southwestern New York, and northeastern counties of Ohio.

LANDIS TOOL CO., Waynesboro, Pa., has acquired the full line of precision surface grinders previously manufactured by the ABRASIVE MACHINE TOOL CO., East Providence, R. I.

New Books and Publications

POWER METALLURGY IN NUCLEAR ENGINEERING. Assembled under direction of Dr. Henry H. Hausner. 275 pages; 6 by 9 inches; illustrated. Published by American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. Price, $8.50.

Here is a volume which should prove of major reference value to engineers and students of this advanced stage of metals technology. Most of the work and findings described therein were under U. S. Atomic Energy Commission sponsorship.

Fifteen chapters range from general metallurgical problems in the design of nuclear reactors through the safe handling of pyrophoric and radioactive metal powders. Powder metallurgy of zirconium, uranium, thorium, beryllium, and various alloys is discussed, as are metal powders, preparation for reactors, ceramic fuel materials, and related topics. There are 243 literature references and 100 charts, tables and graphs, carefully indexed.

AMERICAN STANDARD MANUAL. ASA B5.20-1958. MACHINE PINS. 14 pages; illustrated; 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.50.

This booklet is published by the ASME for the purpose of presenting the results of the investigations of one of its committees—this time, the Sectional Committee on the Standardization of Small Tools and Machine Tool Elements (Technical Committee No. 23 on Machine Pins). Tables and specifications pertaining to dowel, taper, clevis, grooved, and cotter pins are given.

AMERICAN STANDARD MANUAL ASA B18.6.4-1958. 143 pages; illustrated; 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $4.

General and dimensional data are herein presented concerning slotted and recessed-head tapping screws and metallic drive screws. Six appendices cover such subjects as: protrusion and penetration gaging, standard hole sizes for inspection of tapping screws, etc.

Coming Events

MARCH 11-13—Tenth Anniversary Spring Technical Meeting to be held at the Pick-Congress Hotel, Chicago, Ill. For further information write Pressed Metal Institute, 3673 Lee Road, Cleveland 20, Ohio.

MARCH 16-20—Western Metal Show to be held at Pan-Pacific Auditorium, Los Angeles, Calif. Contact American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

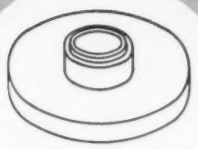
MARCH 19-20—National Production Meeting, Society of Automotive Engineers, to be held at the Sheraton-Cadillac, Detroit, Mich. Contact Robert W. Crory, Public Relations Manager, SAE, 485 Lexington Ave., New York 17, N. Y.

APRIL 18-22—ASTE Annual Meeting to be held at the Schroeder Hotel, Milwaukee, Wis. Contact American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.; Harry E. Conrad, executive secretary.

MAY 4-8—National Industrial Production Show of Canada at Exhibition Park, Toronto, Canada, under management of E. M. Wilcox, 19 Melinda St., Toronto, Canada.

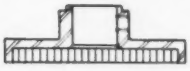
Bodine

CASE HISTORY NO. 48...



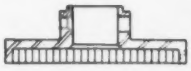
Hand load blank to fixture-type dial. Auto inspect and clamp.

1



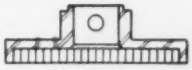
Drill .173″ dia. one side. Horizontal drill spindle.

2



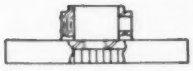
Drill .116″ dia. 2nd side and chamfer. Combination tool. Horizontal drill spindle.

3



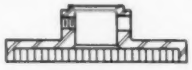
Drill .187″ dia. hole through. Vertical drill spindle.

4



Tap #6-40 CL 3 hole to size. Horizontal tap spindle. ALSO drill .187″ dia. hole. Vertical drill spindle.

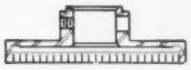
5



Countersink .430″ dia. with Welden 90° c/sink. Vertical drill spindle.

Auto inspect for broken drills or taps.

6

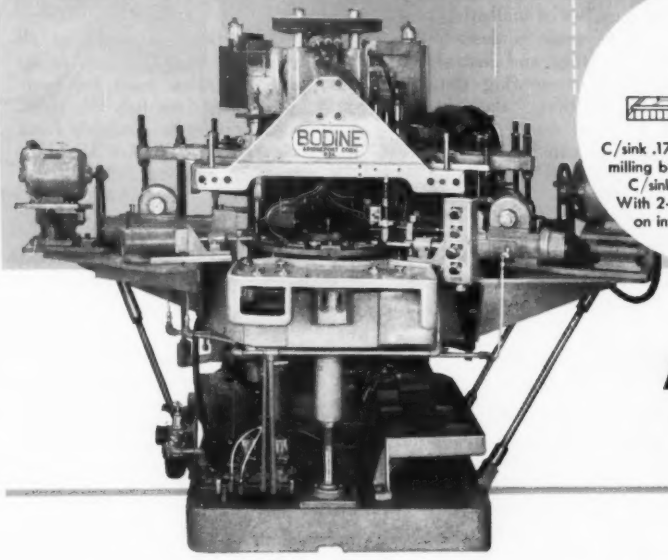


Undercut teeth using special recessing tool. Inverted drill spindle. (Hold down vertically.)

7

Gang mill .062″ slot and flat. Vertical milling spindle.

8



C/sink .173″ dia. hole to remove milling burr. Horiz. drill spindle. C/sink 2 .187″ dia. holes. With 2-spindle multiple-head on inverted drill spindle.

9

Ream .430″ dia. to remove burr. Vertical drill spindle.

10

All this and better QUALITY CONTROL too!

PART and MATERIAL: Clutch drum, steel B1117

PRODUCTION: 4200 operations (300 pieces completed) per 50 min. hour.

The remarkable versatility of Bodine Basic Machines and tooling methods is well illustrated by this recently completed unit for Teletype Corporation. Production, however, is only part of the story. Superior *quality control* was the main reason for development of this new production method for Teletype.

The part is a steel clutch drum on which no less than *14 operations* are performed, with two automatic inspections built into the cycle.

There are 4 vertical drill spindles and 1 vertical milling spindle; 3 horizontal drill spindles and 1 horizontal tap spindle; 2 inverted drill spindles. Parts are hand-loaded but automatically ejected. The station is washed after ejection.

Just think what it means in the production of a part like this when one compact machine and one easily maintained set of tooling can handle *4200 operations* per hour to close limits, plus control inspections. Yet this is only one of many outstanding examples of Bodine practical aid to cost or quality-troubled manufacturers. Send us your next tough job . . . parts or prints . . . for production analysis. Write Dept. M-2.

THE Bodine CORPORATION

BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

2BD58

For more data, circle this page number on inquiry card

Obituaries

Ralph S. Howe

RALPH S. HOWE, aged sixty-seven, president of the New Britain Machine Co., died on January 13. An authority on machine tools and metals, Mr. Howe joined the company thirty-eight years ago. He became president in 1954. Mr. Howe was a former director of the Metal-Working Equipment Division of the National Production Authority in Washington. He was a native of New York City and a graduate of Cornell University.

RUBEN O. PETERSON, age fifty-nine, an outstanding pioneer in the field of power brush engineering, and vice-president, Brush Division—Engineering, of the Osborn Mfg. Co., Cleveland, Ohio, died on December 28. Mr. Peterson became associated with Osborn in 1936 when he joined the company as manager of its technical department. He was elected vice-president, Brush Division—Engineering, in June, 1956. He was active in engineering circles. Mr. Peterson had written a number of outstanding scientific papers on metals and had gained a national reputation in this field.

Ruben O. Peterson

* * *

Campaign Launched by Malleable Producers

Forty-one producers of malleable-iron castings have joined together to launch an educational and promotional campaign on standard and pearlitic malleable that will be of major significance to the metal-working industry. The sponsoring group is officially known as the Malleable Castings Council. Robert LaMarche, president of the group, explained that the sole purpose of the Council is to inform engineers, metallurgists, and purchasing, production, and administrative men about the qualities of malleable iron.

The new program is designed to be both interesting and instructive. In addition to presenting detailed factual information, data units covering a broad range of subjects are offered and can be built into a useful material and manufacturing information file.

$50,000 Machine Design Awards

The James F. Lincoln Arc Welding Foundation of Cleveland, Ohio, is offering fifty-four awards totaling $50,000 for papers describing the use and advantages of arc welding in the design and construction of machines or machine components. Top award to the author or authors of the best paper is $10,000.

Papers may describe how a machine is improved or reduced in cost through the redesign of a casting to a weldment, the redesign of an existing weldment, or the design of a new weldment. Weldments used in practically every type of industrial machinery are eligible.

Dr. E. E. Dreese, chairman of the Foundation, states that the purpose of the new competition is to stimulate and encourage industrial and economic progress through the development of machinery that is more efficient in operation and lower in cost. The efficient application of the advantages of welded steel design, Dr. Dreese states, will accelerate this progress.

The competition is open to all persons in the United States or its possessions. Entries must be postmarked not later than July 20, 1959. The Rules Booklet is available from the James F. Lincoln Arc Welding Foundation, P. O. Box 3035, Cleveland 17, Ohio.

Motion Picture Reviews

FILMS AVAILABLE FROM MACHINE TOOL BUILDERS

A booklet listing 147 available motion picture films on machine tools and machining operations has been published by the National Machine Tool Builders' Association. The films, of which eighty-four are in color, range in showing time from five to seventy minutes, the average being about thirty minutes. All films are available without charge upon request to the member companies producing them and are, with few exceptions, 16-millimeter films with sound. Copies of the booklet are available from the Association at 2071 E. 102nd St., Cleveland 6, Ohio.

PRESS MAINTENANCE

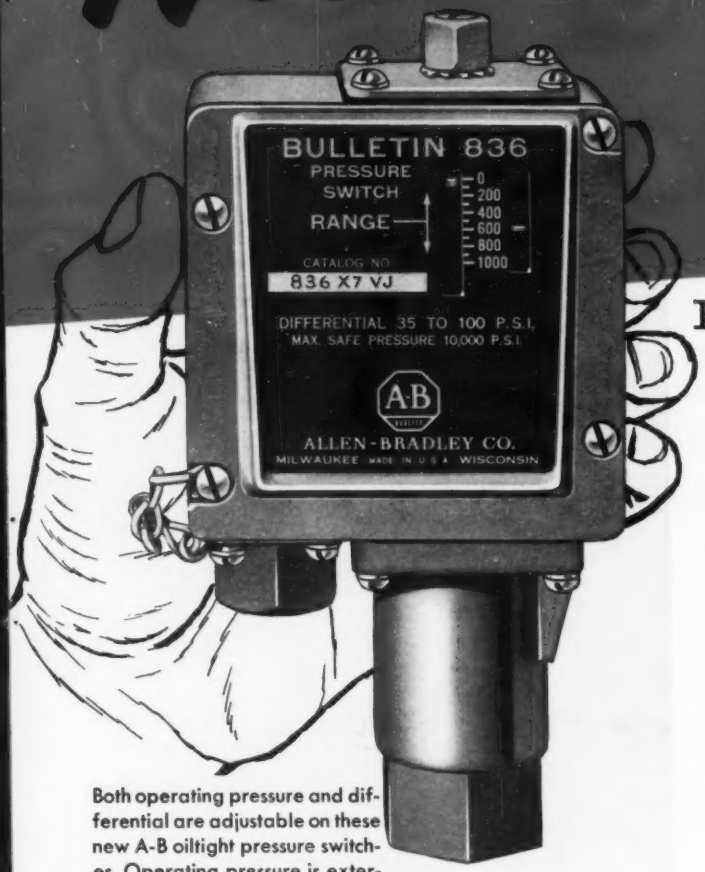
The E. W. Bliss Co., Canton, Ohio, has released a 16-millimeter color and sound film, "High Production Press Maintenance," which describes proper maintenance procedures for high-speed presses. Special emphasis is given to the fast, simple die change-over method, which makes it possible to use such presses even for short runs. Step-by-step construction of a high-production press is also shown. For details write to the E. W. Bliss Co., Canton Ohio, or contact your local Bliss representative.

MACHINING VERSATILITY

A fourteen-minute color and sound film entitled "Key to Machining Versatility" is announced by the Bullard Co., Bridgeport, Conn. The film demonstrates the versatility of the Bullard Hydra-Feed lathe, either for tracer or multiple-tool setups on a wide variety of parts. Reservations for its showing can be made through the advertising department of the Bullard Co.

New ALLEN-BRADLEY OILTIGHT PRESSURE SWITCHES

Bulletin 836 Type T



Both operating pressure and differential are adjustable on these new A-B oiltight pressure switches. Operating pressure is externally adjustable, and setting shows on calibrated scale. A trip indicator shows operating point.

For machine tool hydraulic systems—operating at pressures up to 5,000 psi

Especially designed for heavy duty industrial applications, these new Allen-Bradley oiltight high pressure switches assure long, trouble free life. The attractive die-cast aluminum enclosure is completely sealed to exclude oil and water. The snap-action switch mechanism maintains its high contact pressure to the point of switchover—no matter how slowly it is approached. Contact chatter is eliminated—trouble free contact life is increased. The contact block has two isolated circuits with one N.O. and one N.C. set of contacts.

Send for complete information on this newest addition to Allen-Bradley's wide line of *quality* pilot controls.

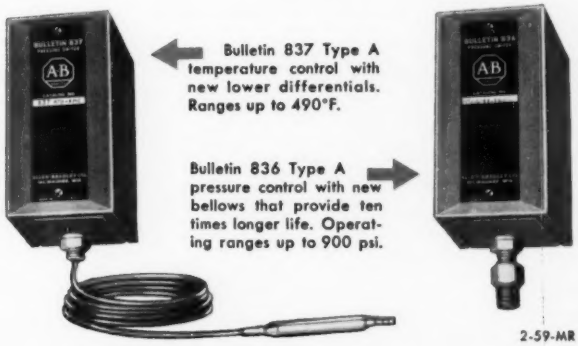
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

A-B QUALITY

Internal view of piston design used on units for systems above 500 psi. Bellows type construction is used up to 500 psi.

Also...A New Line of Pressure and Temperature Controls with Lower Differentials



Bulletin 837 Type A temperature control with new lower differentials. Ranges up to 490°F.

Bulletin 836 Type A pressure control with new bellows that provide ten times longer life. Operating ranges up to 900 psi.

2-59-MR

Allen-Bradley is not satisfied until Limit Switch Life runs into

MANY MILLIONS OF OPERATIONS

Allen-Bradley Bulletin 800T oiltight limit switches on typical life tests have run many millions of operations. Write for complete information on the Allen-Bradley line of quality limit switches for every industrial application.

Here are some new—and some old—Allen-Bradley oiltight limit switches—all built to give you extra millions of trouble free operations. Their switch bodies and operating heads are both sealed. Oil, dirt, and metal chips cannot enter and foul the contacts or cause sluggish operation of the momentary contact mechanism. Double break, silver alloy contacts never need maintenance. The snap action switch is positive insurance against any reduction of the contact pressure as the "trip point" is approached. This means less chance for chatter and arcing of relays, contactors, or starters operated by the limit switch—and prolonged trouble free contact life for the limit switch itself.

The Allen-Bradley line of limit switches is complete. Illustrated are only a few variations.

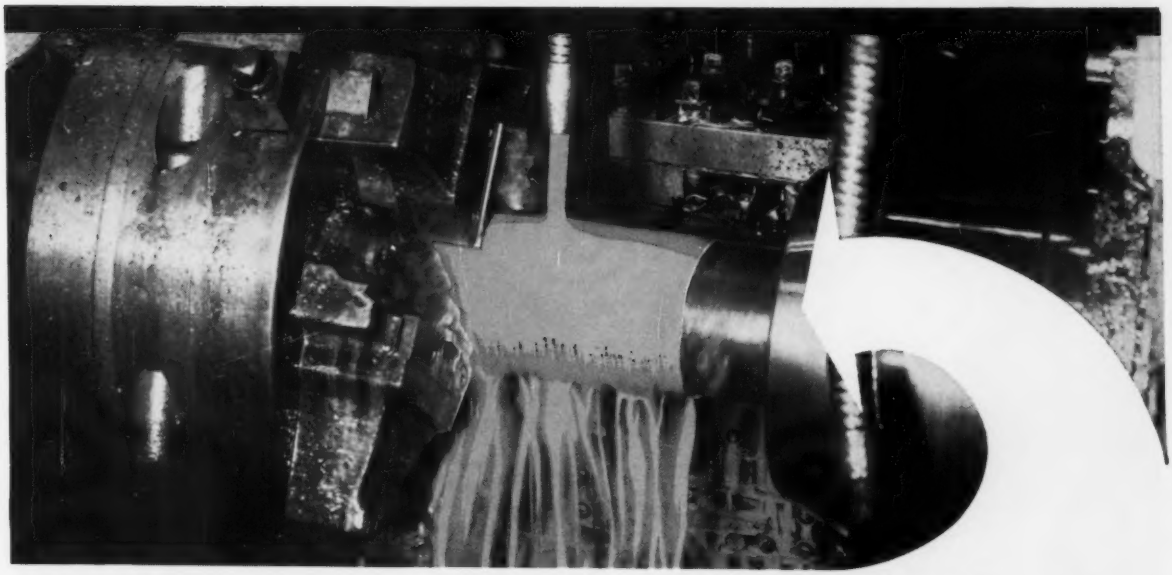
Side Push Rod
Top Push Rod with Plastic Window
Roller Lever for Flush Mounting
Neutral Position Momentary Contact Limit Switch. One set of contacts is closed for each direction of operation.
Adjustable Rod
Adjustable Roller Lever
Wobble Stick Type
Fork Lever Type
Side Push Roller
Roller Lever for Manifold Mounting
Side Push Rod Maintained Contact

2-39-MR

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

a "NEW LEAF" in coolants... New 100% Chemi-Cool HOCUT cools... lubricates... prevents rust... stays mint-fresh for life!



No other cutting fluid does so much, so well, for so long... as NEW HOCUT 237

Permanently odor-free—Needs no "additive" to stay clear and fresh-smelling for life. Cannot turn rancid or harm hands. Keeps your shop clean and your operators happy.

Cools work and tools quickly—Faster cooling speeds machining time—prevents welding and chip build-up, and increases tool life.

A lubricant that works—The secret is in new synthetic high-molecular-weight lubricity additive—which, in plain language, means the needed lubrication advantages of a "soluble oil"—with none of the disadvantages.

Protects tools and work from rust—Work coming off the machine is coated with a two-stage rust preventive. Tools, ways, slides and bearings get permanent protection.

Best for economy—Initial cost is only a few pennies per gallon, in the machine. Expense of clogged filters is practically eliminated and filtration speeded up. HOCUT can be used and re-used for months and disposal is never a problem.

For positive proof of new HOCUT's unique properties and economy—in your own plant—call your Houghton Man today. Or write: E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

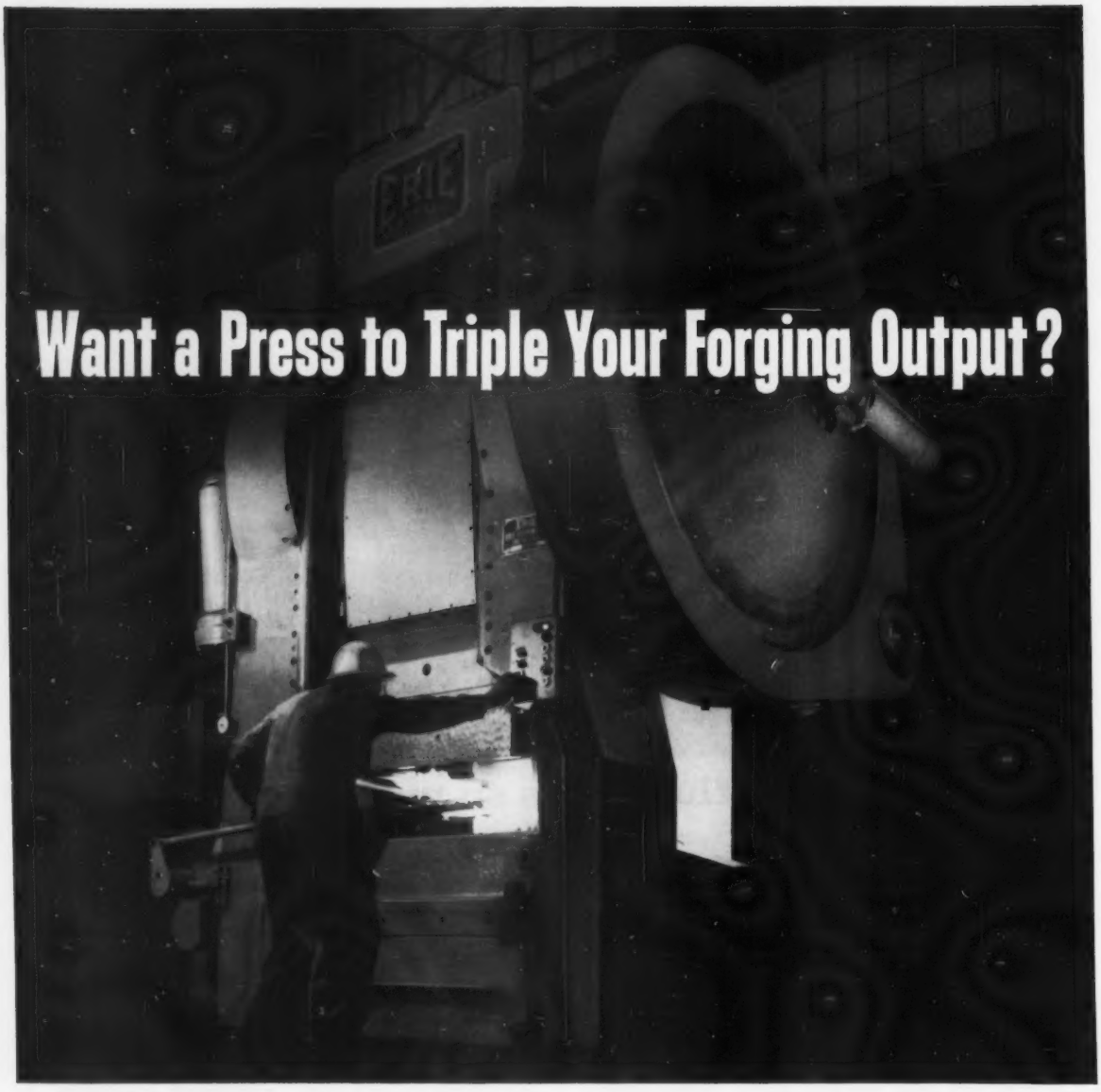
HOCUT 237... *a product of*

E. F. HOUGHTON & CO.

PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO • TORONTO

Ready to give you on-the-job service

For more data, circle this page number on inquiry card



Want a Press to Triple Your Forging Output?

We'll build the press for all your forging requirements . . .

Tell us your forging problems and give us your production specifications—we'll do the rest.

Erie Foundry, one of the first companies to automate forging, can provide specially designed *high volume* presses in capacities of 1000 to 8000 tons. Instead of the three machines and nine men formerly required, now you need only one Erie automated forging press and only one operator observer—to triple your present production rate! Trimming, too, can be accomplished in a single production cycle. With billet supply and finished part removal conveyorized, it is possible to achieve a production volume of, say, 1200 track-link forgings per hour.

Erie Foundry has a complete line of machines designed for high volume production of such parts as connecting rods, gear blanks, automotive and tractor valves, pinions, track links and wheel hubs.

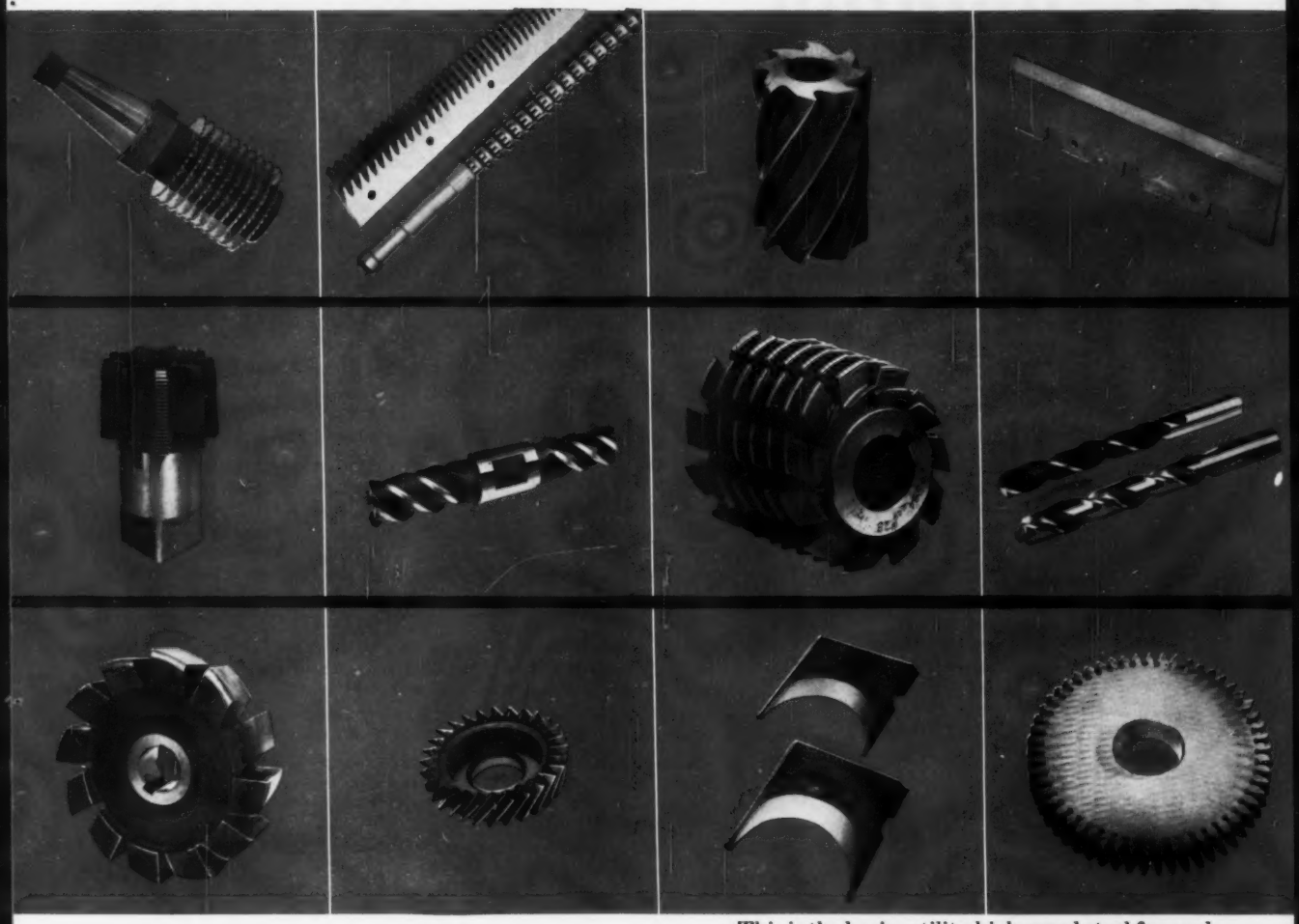
We would like to discuss application of automated presses to your production requirements. For the complete story, phone or write Mr. R. E. Sanford, Erie Foundry Company, Erie 5, Pa.

ERIE

ERIE FOUNDRY CO.

The world's great name in forging since 1895 EF-59-01

used almost everywhere . . . for almost everything!



America's staple high speed steel

VASCO M-2

This is the basic, utility high speed steel favored by toolmakers and toolmaking departments of industries throughout the country. Versatile, dependable VASCO M-2 is always readily available in standard and special rolled shapes, hammer-finished bars, blocks, disc and ring forgings, plate, sheet, discs and rings punched from sheet, drill rod, tool bits. Ground finish is obtainable on all items when desired. VASCO M-2 is also furnished in free-machining (FM) grade. Large stocks are maintained in principal manufacturing centers.

• *Write for technical Data Sheet.*

Made and guaranteed by the makers of famous

Red Cut Superior . . . Vasco Supreme . . . Neatro . . .

and many other first quality high speed steels known

and preferred throughout industry.

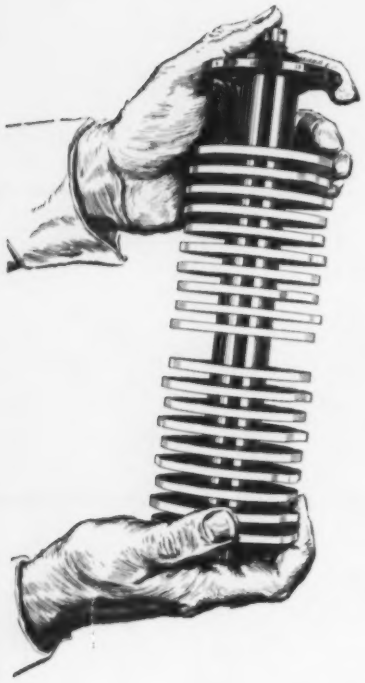
Vanadium-Alloys Steel Company

LATROBE, PENNSYLVANIA

DIVISIONS: Anchor Drawn Steel Co. • Colonial Steel Co. • Metal Forming Corporation • Pittsburgh Tool Steel Wire Co.

SUBSIDIARIES: Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni • EUROPEAN ASSOCIATES: Societe Commentryenne Des Aciers Fins Vanadium-Alloys (France) • Nazionale Cogne Societa Italiana (Italy)

He's holding an automatic cycle



Multi-cycle programmer is the name. And it's only one of many built-in features which make the Monarch Model 21 Mona-Matic the most productive automatic cycle lathe available today.

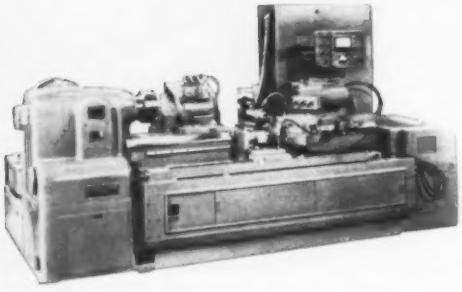
You can use the Model 21 for a hundred or a million parts. The programmer method cuts setup time to such an extent that switching over from one part to another is accomplished just about as quickly as job change on an engine lathe.

The Model 21 has all the power needed to utilize the full productiveness of carbide tooling; has the speed to fully realize the economies inherent in ceramic tooling.

This machine may be used with equal efficiency on one, two, three or four cut cycle work while the switch from one cycle to another is accomplished in most cases by doing nothing more than changing multi-cycle programmer and making a few quick readjustments.

Get all the benefits of the time-proved "Air-Gage Tracer"—the most accurate lathe duplicating device known. It's so fast in operation that the only limitation in cycle speed is imposed by what the tool will stand.

When you buy a production lathe, RESULTS are what you want. That's what you get in the Model 21. Booklet 1808, yours for the asking, tells why in detail... **The Monarch Machine Tool Co., Sidney, Ohio.**



- Exclusive automatic feed change with up to six different feeds, each of which is infinitely variable and each of which may be made operative at any time during the cycle.
- All feeds adjustable under cut. This often lengthens tool life and thereby increases day in and day out productiveness.
- "Air-Gage Tracer" utilizes the combination of air-hydraulic control with a stylus pressure of only five to six ounces against the template. There is no appreciable template wear; accuracy of template shape reproduction is within ±.001" on most jobs.
- All way surfaces flame hardened and ground. The accuracy built in is retained year after year.
- Work piece change speeded by a single multiple position lever on tailstock. In proper sequence it controls both the tailstock center and the air operated chuck.
- Rugged rear carriage for auxiliary machining operations, timed to take its cut at any point during the cycle.
- Automatic lubrication; from end to end, all the time.

Flexibility Unlimited

With such optional equipment as (1) inbuilt constant surface cutting speed, (2) automatic indexing two-position tool holder, (3) power chip conveyor and (4) chip and coolant guard.

Monarch TURNING MACHINES

FOR A BETTER TURN FASTER... TURN TO MONARCH

GOOD NEWS FOR COST MINDED TOOL ENGINEERS

STANDARDIZED UNIVERSAL INDEX PLUNGERS COST 75% LESS THAN SPECIALLY-MADE TOOL ROOM PLUNGERS

In jig or fixture manufacture, it's both expensive and time-consuming to design and machine special index plungers for multi-station tools. To save time and money use Universal Straight or Taper Plungers. They are made in standard sizes . . . come complete, ready for installation . . . at approximately ¼ the cost of specially made tool room plungers. Universal Index Plungers can be assembled from either top or bottom and can be removed in either direction. Because the Universal plunger body and bushing have the same standard diameter . . . all holes can be bored with the same tool, simplifying drilling of jig or fixture in fabrication.

Universal Index Plungers can be actuated by either hand lever or air cylinders for automatic indexing tools. The locating bushing, plunger and plunger bushing are hardened and ground . . . precision built for extreme accuracy and long wear. Write for catalog detailing plungers plus other Universal production tools.

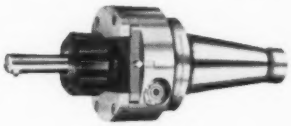
OTHER PRECISION-BUILT COST-SAVING UNIVERSAL PRODUCTION TOOLS

211

Floating Chuck

Standard Collet Chuck

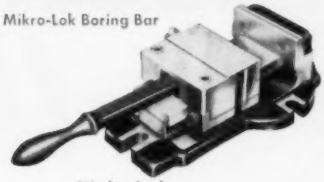
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 2, MICHIGAN

MEL-TROL®

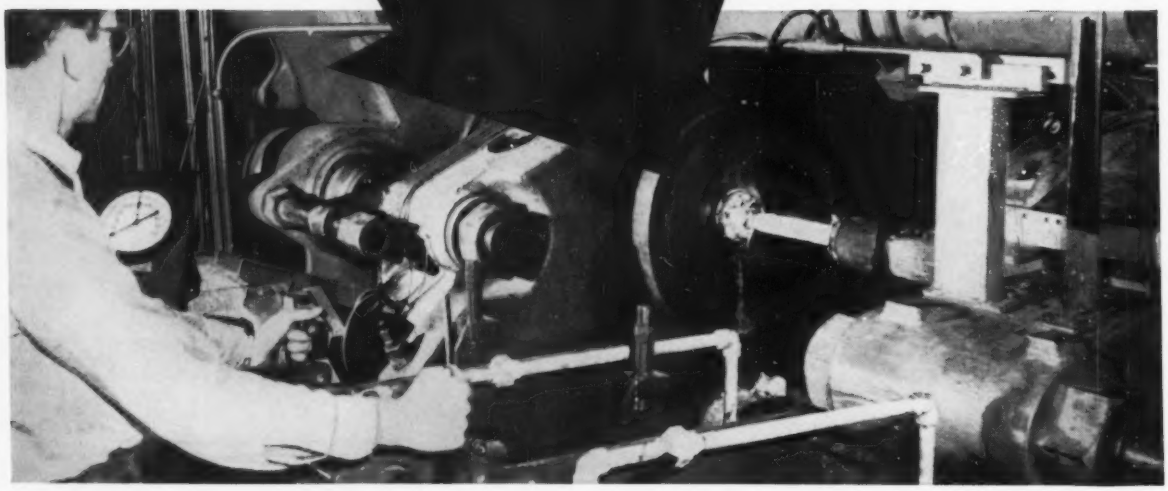
at work

An extrusion die's performance depends on strength and toughness at its center. And the center can only have as much strength and toughness as the ingot from which it came.

That's why MEL-TROL hot work die steels, *Carpenter* No. 345 and No. 883, for instance, invariably outperform other die steels used in aluminum extrusion.

MEL-TROL is a system combining the newest and best quality controls and an exclusive new, patented ingot mold. It produces ingots that are of consistently greater uniformity and better quality through the core than any die steels yet produced by conventional methods.

Ask for *Carpenter* No. 345 and No. 883. Your *Carpenter* representative will help you select the one best for your needs from large local stocks. Place your order today.



Carpenter STEEL

The Carpenter Steel Company
Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

interchangeable with all standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1½ to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures . . . and is also adaptable to the use of low pressure oil as the working medium. Write to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1 One Piece Piston

2 Hard Chrome Cylinder Bore and Piston Rods

3 High Tensile Steel Tie-Rods

4 Cushion Adjusting Screw, Externally Adjustable

5 New Super-Cushion for air, or Self-Aligning Master Seal for Oil (T-J Patents)

6 Solid Steel Heads and Mounting Plates Standard all Models

7 Port Design Allows Minimum Pressure Drop on Inlet or Outlet

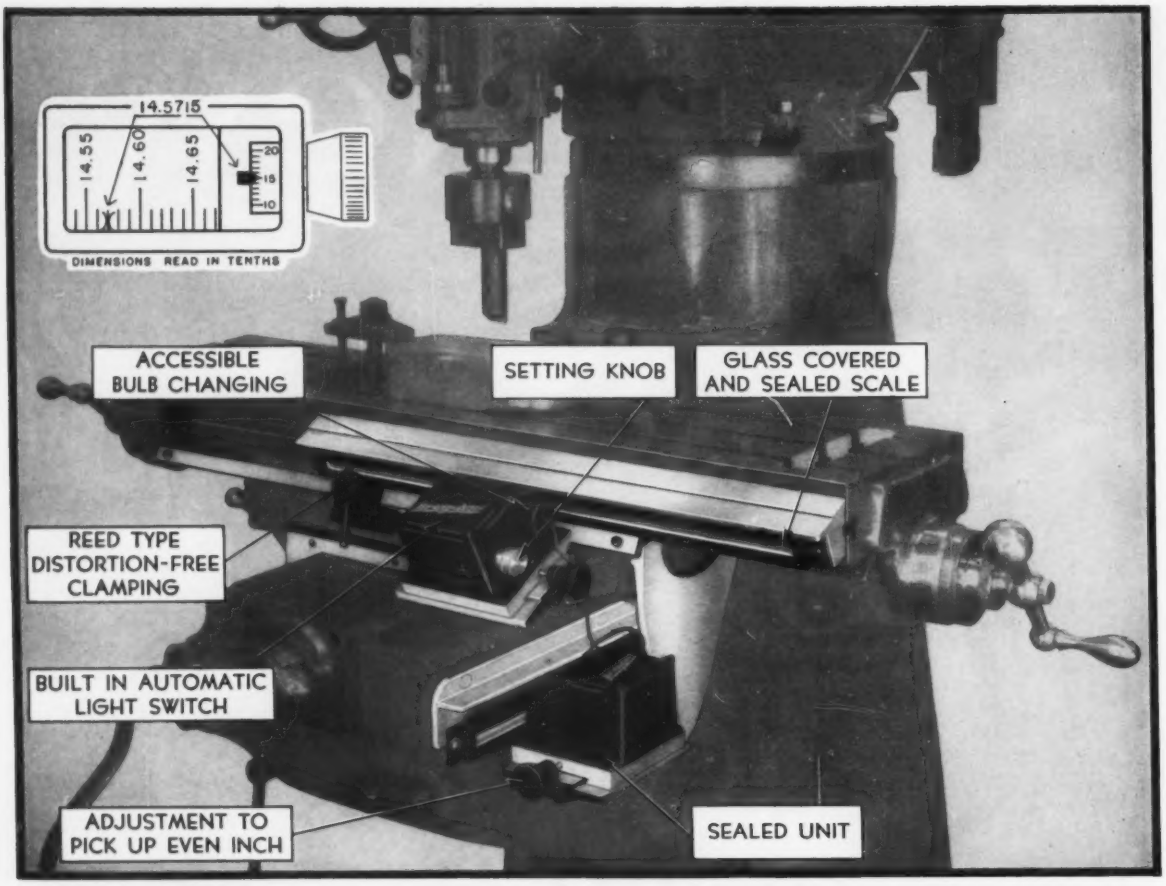
8 Chevron Type, Self-Adjusting Rod Packing

9 Piloted Packing Gland–Absolute Alignment

10 Piston Rod, Extra Strong–Polished and Chrome Plated for Efficiency and Protection

T-J TOMKINS-JOHNSON

For more data, circle this page number on inquiry card



The New Bridgeport OPTICAL SYSTEM

. . . fast, accurate and efficient

By using the NEW BRIDGEPORT Optical System it is now possible to read a figure on the scale as it appears on the working drawing. It is not necessary to add any figures or make any vernier estimations. The operator's skill in reading a single line is all that is required.

The new BRIDGEPORT Optical System is an accurate and time-saving method for quick positioning of table in both planes.

The Optical System is installed at factory on new machines and is easily installed in the field on any BRIDGEPORT MILLER already in service.

Further facts are available through your nearest dealer or through us direct.

Bridgeport MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

Tool Steel Topics

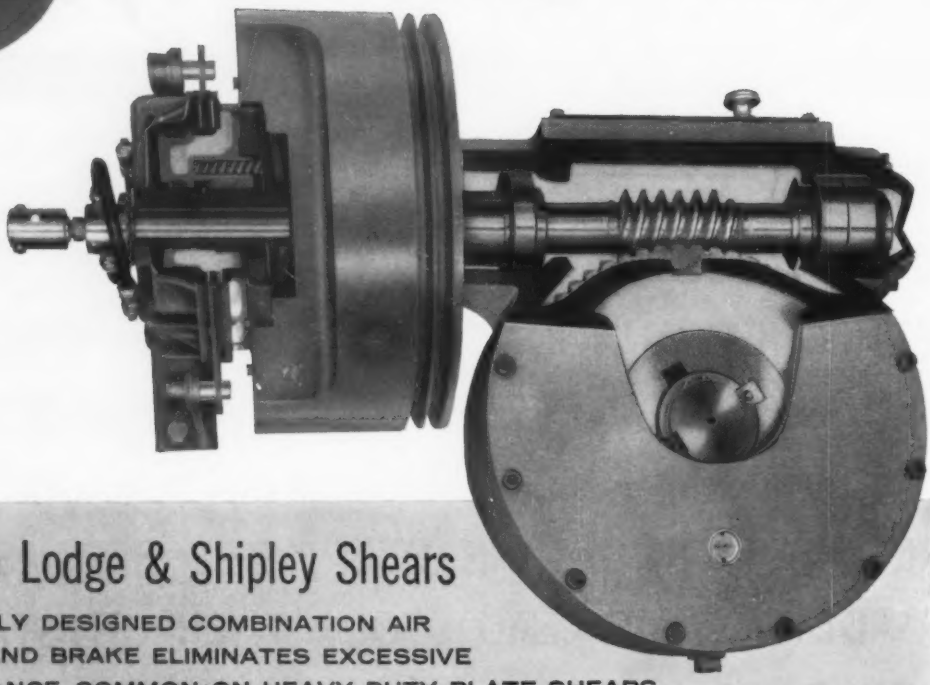
BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

TO ALL TOOL AND DIE MAKERS:
BETHLEHEM ANNOUNCES AIR-4, A NEW FREE-MACHINING TOOL STEEL WHICH AIR-HARDENS AT LOW TEMPERATURE STOP AIR-4 HAS EXCELLENT FREE-MACHINING CHARACTERISTICS BECAUSE OF ADDITION OF LEAD STOP OTHER OUTSTANDING PROPERTIES INCLUDE EXCELLENT WEAR RESISTANCE AND HIGH TOUGHNESS FOR GENERAL-PURPOSE TOOLING STOP AIR-4 IS A DEEP-HARDENING GRADE AND HARDENS AT ABOUT 1550F STOP OTHER ADVANTAGES INCLUDE 1. SAFE HARDENING 2. MINIMUM SIZE CHANGE DURING HEAT-TREATMENT
3. LOW HEAT-TREATMENT COSTS AND MINIMUM DECARBURIZATION STOP
WRITE BETHLEHEM STEEL COMPANY, BETHLEHEM, PA., FOR FULL DETAILS

EXTRAS on the machine . . . not on the invoice!



Only on Lodge & Shipley Shears

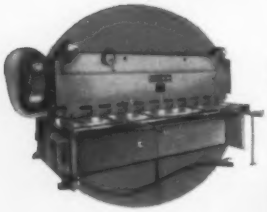
...SPECIALLY DESIGNED COMBINATION AIR CLUTCH AND BRAKE ELIMINATES EXCESSIVE MAINTENANCE COMMON ON HEAVY DUTY PLATE SHEARS

The "standard extras" you find on Lodge & Shipley Shears, although not reflected in the price, are important in time-saving, effortless operation, accuracy and low-cost service.

THE COMBINATION AIR CLUTCH AND BRAKE, for example . . . its single unit design positively eliminates overlap between clutch and brake. Disc-type construction is self-adjusting for fast, smooth starting and safe, positive stopping. The clutch provides automatic overload safety; the brake applies automatically in the event of electrical or air supply failure.

NO OTHER SHEAR, EVEN AT EXTRA COST, can offer the exclusive combination of features found, for instance, on the ½" Lodge & Shipley Shear:

- 2-stage Hydraulic Holddown System
- Remote-operating Foot Control • Ball Transfer Table
- Motorized Front-Operated Back Gauge
- One-piece Shaft with Integral Eccentrics
- Blade Clearance Indicators • Air Counterbalances
- Air-cushioned Back Gauge • Blade Changing Jigs
- Fast, One-man Upper Blade Adjustment
- Independent Holddown Fingers • Quad-life Worm Gear

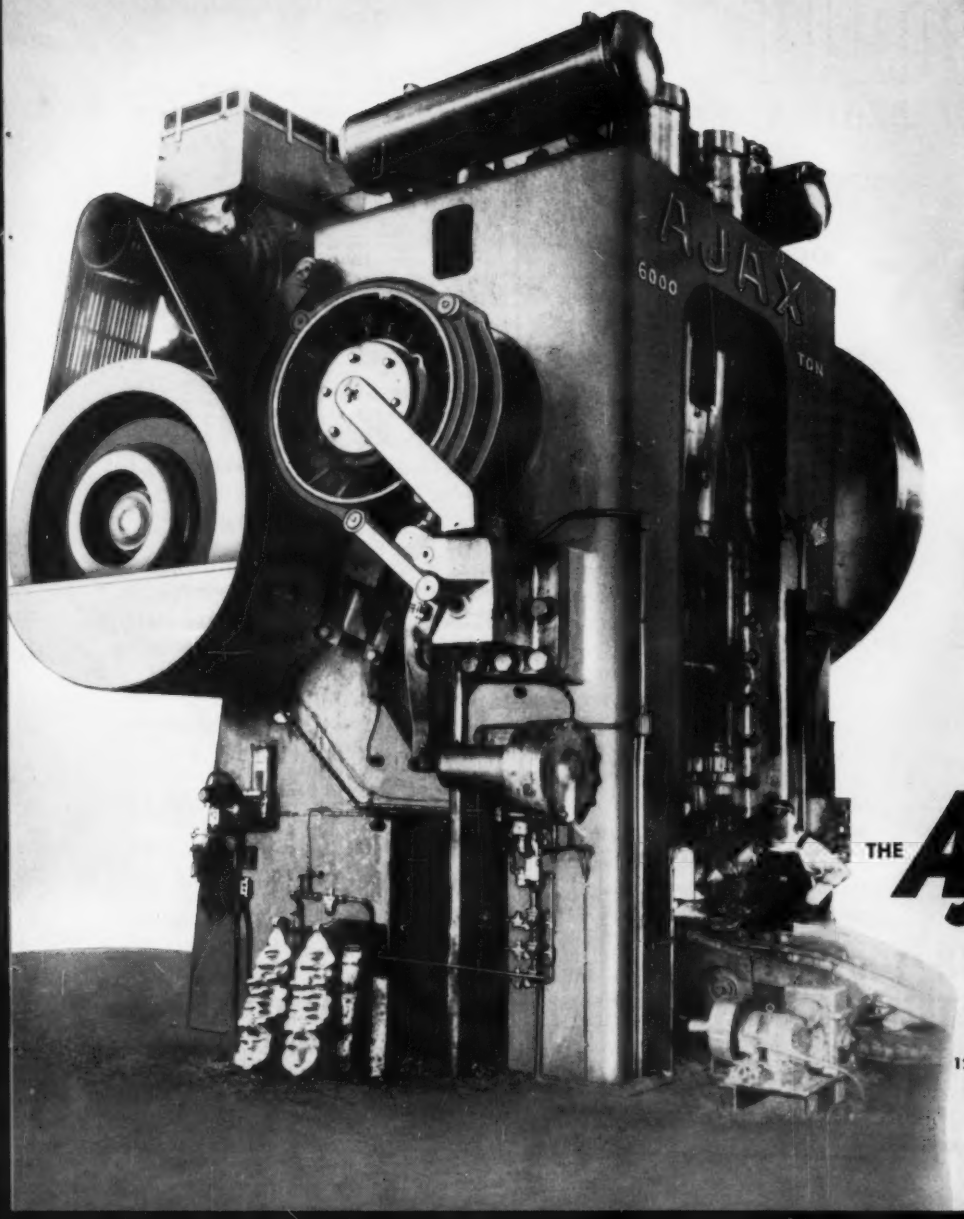


Capacities to ½" x 12'

Find out how much more you get . . . **WITHOUT EXTRA COST** . . . on a Lodge & Shipley Shear. For details, see Sweet's Machine Tool File or request Bulletin No. PS-15 from: **The Lodge & Shipley Co., 3057 Colerain Ave., Cincinnati 25, Ohio.**

Lodge & Shipley Your LODGE-ical Choice!

High Production of Automobile Crankshaft Forgings on AJAX *High Speed* Forging Presses



Production More than Doubled Over Former Methods on 6000 Ton Ajax Forging Presses

Crankshafts With Less Draft on Counterweights for Lower Machining Costs

For Your Forging Needs . . . Ajax Forging Presses Sizes 300 Ton to 8000 Ton

THE **Ajax** MANUFACTURING COMPANY

CLEVELAND 17, OHIO

110 S. DEARBORN ST., CHICAGO, ILL.

W. P. WOOLDRIDGE CO.

1209 BURLINGAME AVE., BURLINGAME, CAL.
6440 FLEET ST., LOS ANGELES 22, CAL.

Write for Bulletin 75 C

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

ABRASIVES, Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

Norton Co., 1 Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

2738

Hamilton

SUPER SENSITIVE DRILLING MACHINES

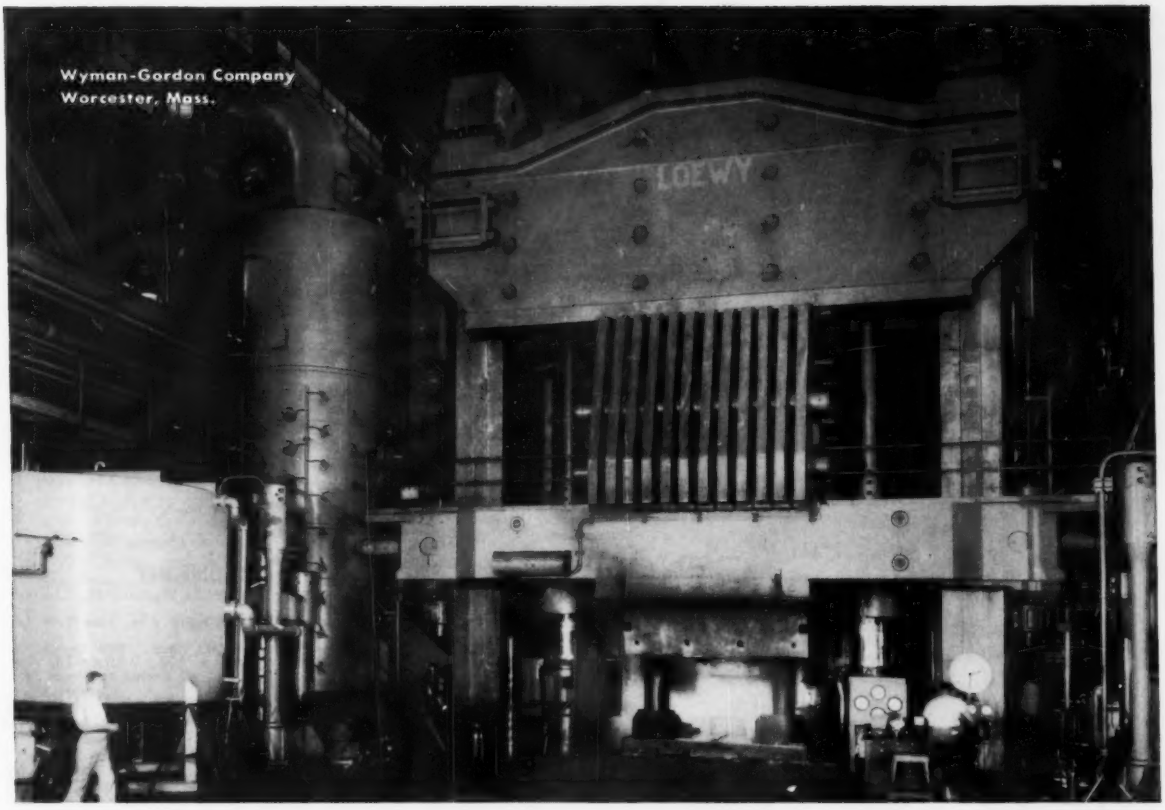
* IN ALL DRILLABLE MATERIALS

FOUR STANDARD MODELS
MANY VARIANTS

Write for FREE
Information Batch
No. D-820

This is the Hamilton Varimatic® Super Sensitive Precision Drilling Machine equipped with "tool-room base" and compound table.

THE HAMILTON TOOL COMPANY
834 SOUTH NINTH STREET • HAMILTON • OHIO



Operation Big Squeeze:

World's largest presses lubricated by Cities Service Pacemaker Hydraulic Oils

Once a forging operation for horse-drawn carriages, Wyman-Gordon Company now operates the world's largest presses, with the newest one capable of exerting 50,000 tons pressure.

Reason for this tremendous press is the increasing need for strong, lightweight metal parts for aircraft. Today, as for many years, no military or transport aircraft takes to the air without Wyman-Gordon forgings.

With its huge, hydraulically operated presses, Wyman-Gordon is able to forge huge pieces with one big squeeze. Sometimes a whole unit for a landing-gear strut. Or one mammoth wing spar.

The press that exerts 50,000 tons pressure is described by Wyman-Gordon as "the largest single machine ever conceived"—and few people would argue the point after seeing it.

Mounted in a pit that extends nine stories beneath the earth, the giant press is over 114 feet high and weighs 10,605 tons, 6,450 of which moves up and down.

Cities Service is justifiably proud that here as in all of Wyman-Gordon's presses with 18,000 tons pressure or better, hydraulic lubrication is provided by Cities Service Pacemaker Oils.

It is hardly necessary to point out the incredible demands that such machinery makes of its hydraulic lubricants... and certainly it is self-evident that if Cities Service Pacemaker Oils can perform satisfactorily in the world's largest presses, they'll do the same for you. Talk with a nearby Cities Service Lubrication Engineer. Or write: Cities Service Oil Co., Sixty Wall Tower, New York 5, N. Y.

Entire Rig Is Operated by One Man with the few simple controls shown here. With a flick of his fingers he can put on a squeeze of 50,000 tons. Result is extremely strong lightweight forgings for aircraft.

Lubrication Foreman has mammoth responsibility. Here, he checks dispenser for Cities Service EP 20 Lubricant... used on main bed and columns of large presses and other areas subject to extreme pressures.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more data, circle this page number on inquiry card

10 REASONS WHY YOU'LL SAVE!

MEMBER ASMMA

Blue Devil

SOCKET SCREW PRODUCTS

The 10 reasons why you'll be ahead when you need socket screw products and dowel pins are the 10 items in the Blue Devil line. Uniformly high in quality, design and dependability, they're sure to save you time and money. See your Blue Devil distributor for the details and complete literature.

Actual cross-section diagram shows how cold forming of Blue Devil Socket head insures unimpaired fiber continuity.

SOLD ONLY THROUGH AUTHORIZED INDUSTRIAL DISTRIBUTORS

SAFETY SOCKET SCREW COMPANY

6513 North Avondale Avenue, Chicago 31, Illinois

Warehouses at: Los Angeles • San Francisco • Detroit • New Haven • New York City

ARC WELDERS—See Welding Equipment, Arc

ASSEMBLING MACHINES

Detroit Power Screwdriver Co., 2799 W. Fort St., Detroit 16, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Sheffield Corp., Box 893, Dayton 1, Ohio

AUTOMATIC SCREW MACHINES—See Screw Machines, Single and Multiple-Spindle Automatic

BABBITT

Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BACTERICIDES

Lilly, Eli and Co., Indianapolis 6, Ind.

BALANCING EQUIPMENT

Balance Eng. Co., 5024 W. Lake St., Chicago 44, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALLS

Hoover Ball & Bearing Co., Ann Arbor, Mich.

BAR MACHINES—See Screw Machines, Single and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous

Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Mueller Brass Co., Port Huron, Mich.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BAR STOCK AND SHAFTING, Steel

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES

Fafnir Bearing Co., New Britain, Conn.

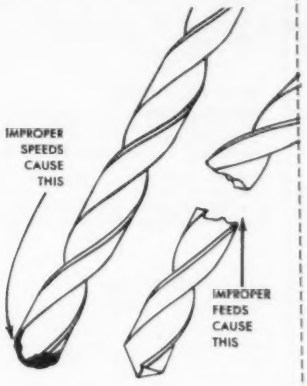
BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Japan Bearing Export Co., Ltd., Tokyo, Japan
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia, Penna.

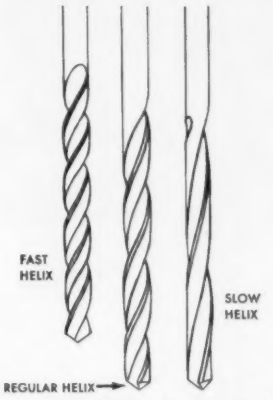
BEARINGS, Bronze and Special Alloy

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio

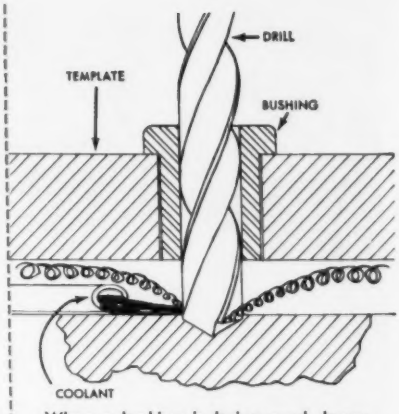
DRILLING TIPS YOU CAN USE



Improper speeds and feeds are responsible for most drilling failures. Never guess. Always use speed and feed suggested for specific materials and for size of drill being used. Always follow drill manufacturer's recommendation.



Use a drill with the helix best suited for the material. In general, **slow helix** is for brass, hard rubber, plastics. **Regular helix** for steel, forgings, castings, general purpose drilling. **Fast helix** for die castings, aluminum, zinc, copper.



When a bushing is being used, leave ample space between bushing and work piece for chip clearance. A space equal to the drill diameter is usually adequate. Apply copious flow of coolant in this space to assure reaching drill point.

FOR QUICK SOLUTIONS TO **ALL** YOUR DRILLING-REAMING PROBLEMS,
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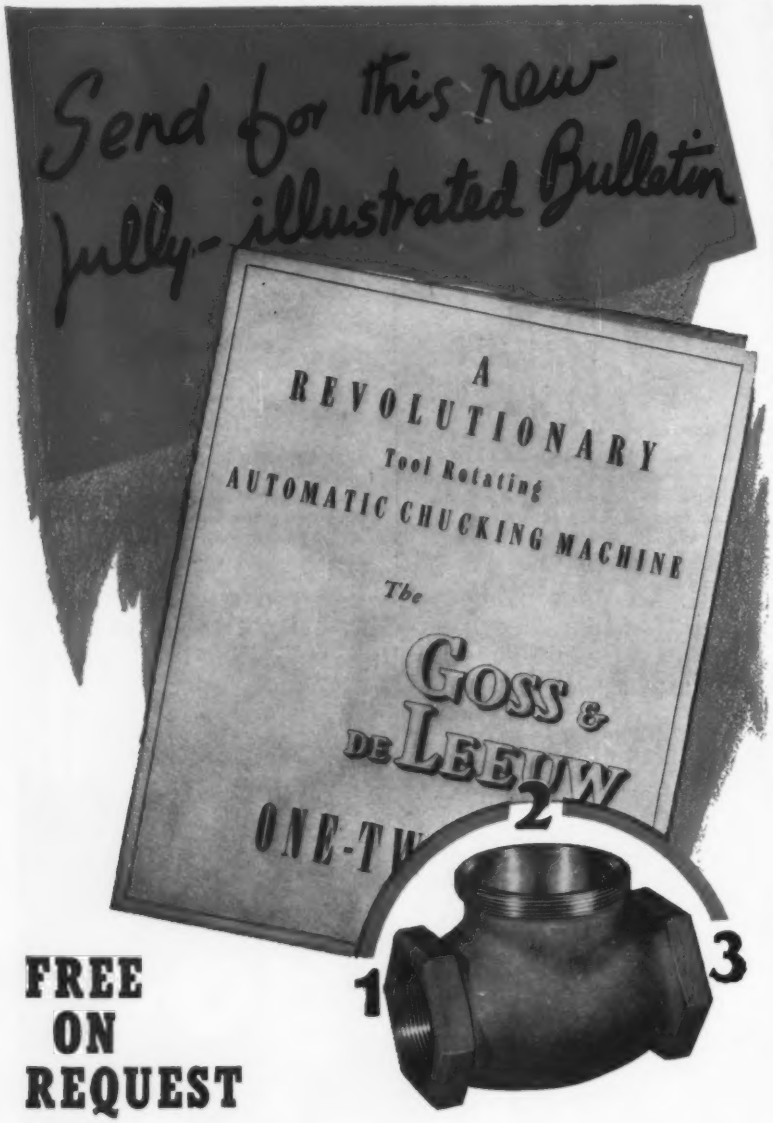

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only *Lapmaster* would guarantee a flatness of ±.00005″ on parts weighing 4920 lbs.

Proper functioning of this vital missile tracking equipment required the highest degree of accuracy obtainable in flatness and parallelity on several component parts . . . some of unusual weight and size. Of all the precision machine tool manufacturers asked to submit recommendations and quotations, only the Lapmaster Division of Crane Packing Company would guarantee to meet the tolerances.

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This job also required a machine with the versatility to handle a variety of small parts as well as the big ones. This customer found—as hundreds of users have—that size, shape or form is no problem to a Lapmaster.

On any job—flatness of the lap plate is continuously maintained by the patented reconditioning action of the conditioning rings.

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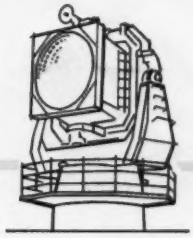

JOB DATA

THE PARTS: Several component parts of a tracking antenna for a long-range radar system. Largest was weldment weighing 4,920 lbs. and measuring 84″ in diameter with bearing lands of 48″ O.D. x 46″ I.D. and 14″ O.D. x 12″ I.D. (see photo).

THE SPECIFICATIONS: Flatness and parallelity had to be held to ±.00005″ with bearing lands lapped on the same plane. Faces on mating part are also being lapped to the same specifications.

THE MACHINE: Standard Lapmaster Model 84 equipped with an 85″ O.D. x 10″ I.D. lap plate. Special roller bar with simple mountings and fixtures to control position of the odd shaped parts during lapping.

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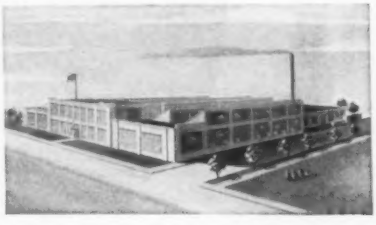

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(Continued on page 238)

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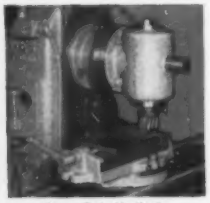
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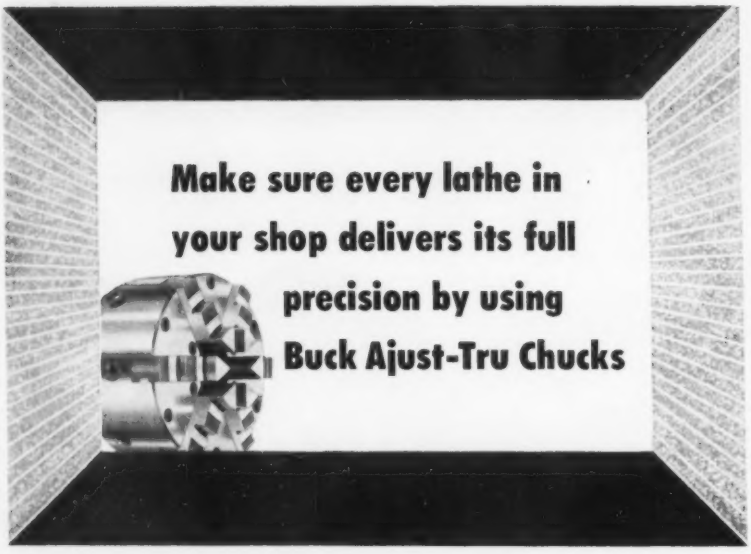
GOOD buying habit



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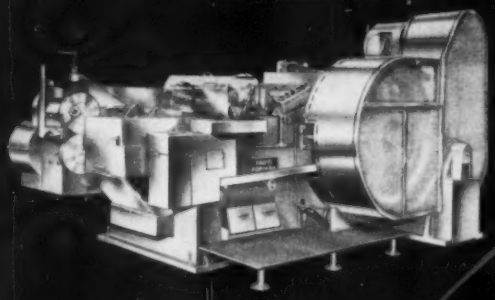
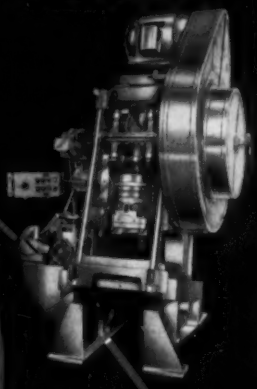


POWER
PRESSES



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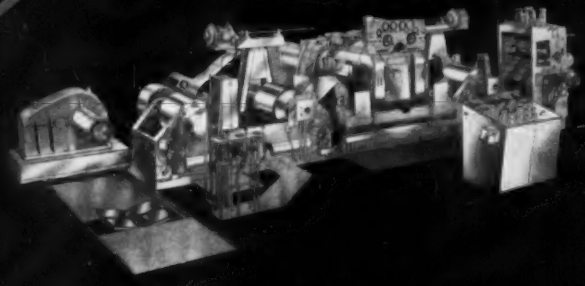

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Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Combination Universal-Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck Co., Windsor Locks, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill, Key Type
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37 N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

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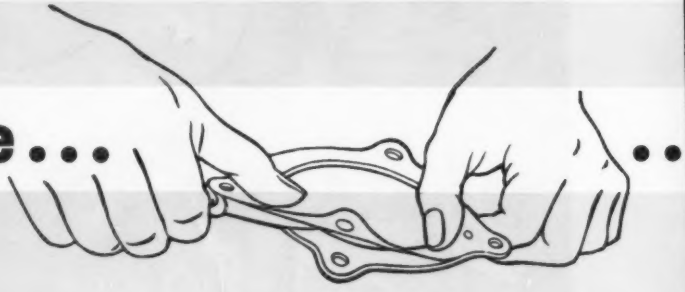

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Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

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Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Horton Chuck Co., Windsor Locks, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

CHUCKS, Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck Co., Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Walker, O. S. Inc., Worcester, Mass.

CHUCKS, Power Operated
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
Jacobs Mfg. Co., West Hartford 10, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

CHUCKS, Universal Three-Jaw
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Horton Chuck Co., Windsor Locks, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Oakite Products, Inc., 26 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works, Co., 3817 St. Clair Ave., Cleveland 14, Ohio.
Conway Clutch Co., 2747 Colerain Ave., Cincinnati 25, Ohio.
Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Minster Mch. Co., Minster, Ohio.

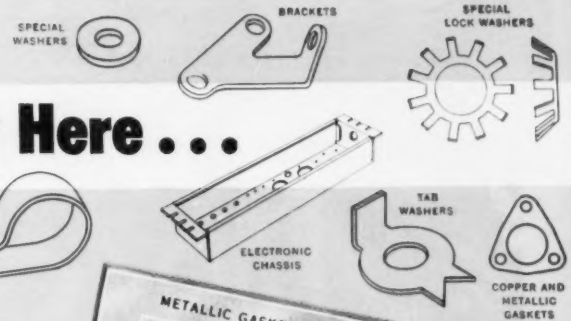
COLD HEADING
National Machinery Co., Tiffin, Ohio.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 883, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.



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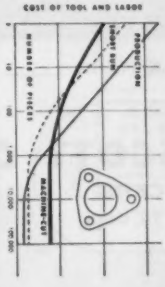

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Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

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Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.

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Barnes, W. F. & John Co., Rockford, Ill.

COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave. New York, N. Y.

COUNTERBORES AND COUNTERSINKS
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

COUNTERS
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CUTTERS, Keyseating
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
DoALL Co., Des Plaines, Ill.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
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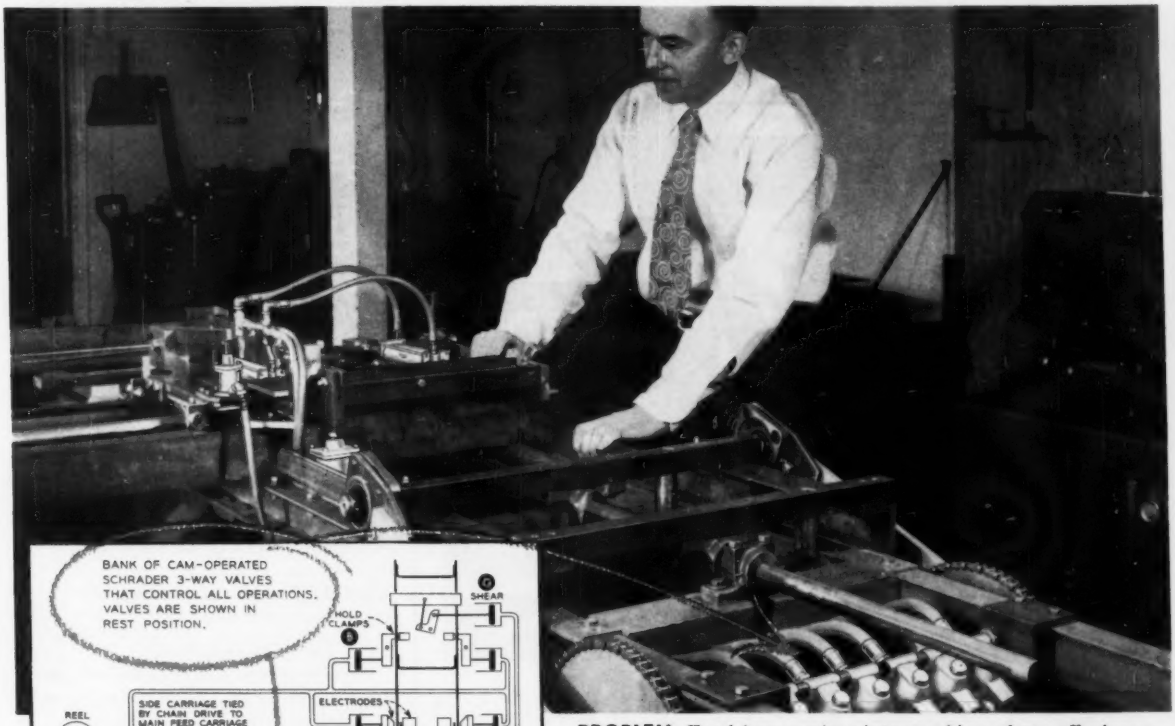

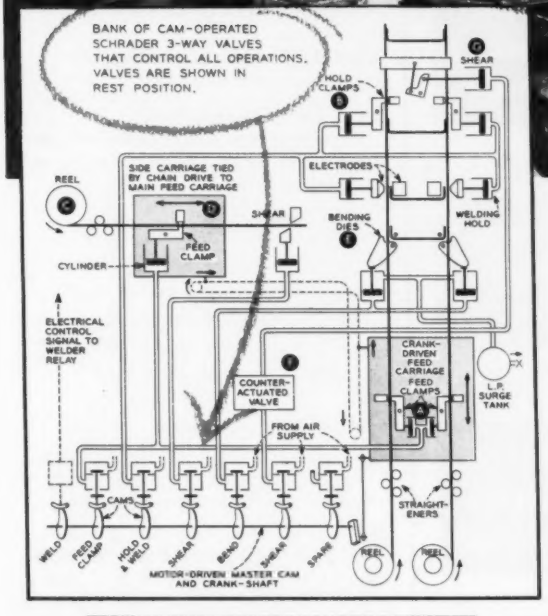

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DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill Co., Rochester, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoALL Co., Des Plaines, Ill.
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Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
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Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoALL Co., Des Plaines, Ill.
Johnson Manufacturing Co., Albion, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.

DEBURRING MACHINES

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Minster Machine Co., Minster, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

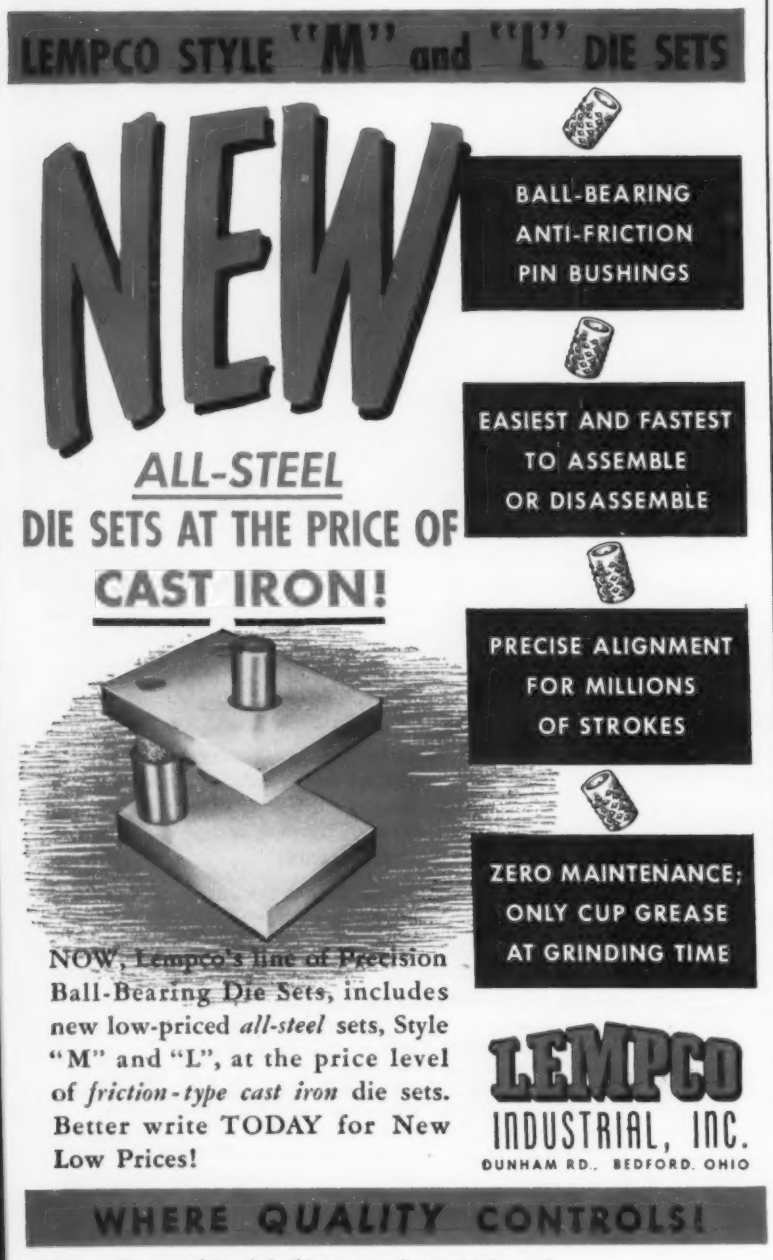
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit Co., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies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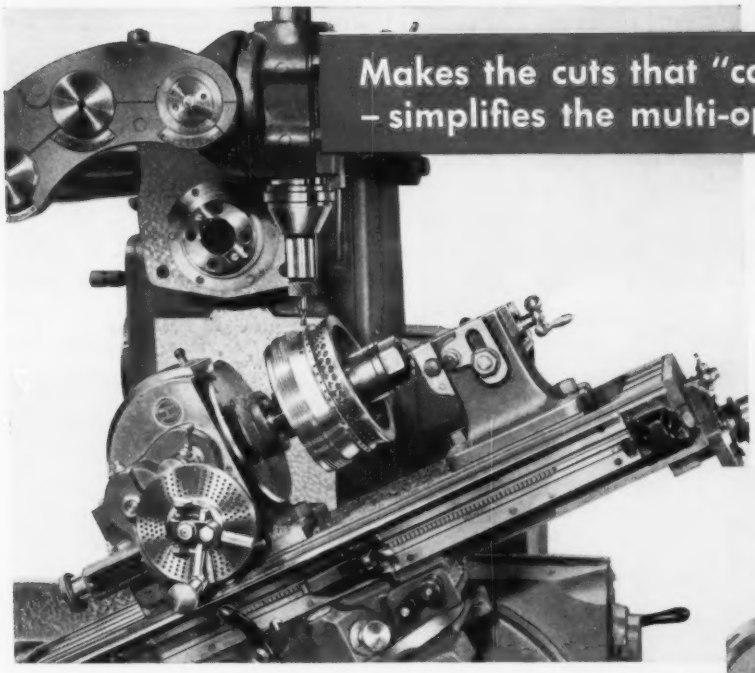
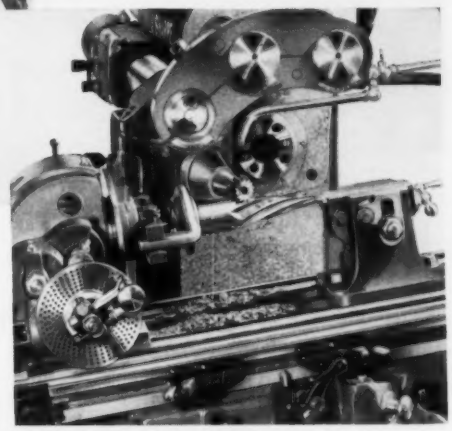


Makes the cuts that "can't be done" – simplifies the multi-operation jobs.

MILLING AT VARIOUS ANGLES WITHOUT RE-LOCATING WORK
Three series of evenly-spaced holes are milled in angular and horizontal surfaces, simply by swiveling the knee and positioning table to bring the work piece to the required position. Illustration shows the last row of holes being milled. No change was needed in the location of the work on the table.

CUTTING SPIRAL TAPER REAMER TEETH
The OMNIVERSAL **only** offers the required combination of motions and settings for many jobs like this.

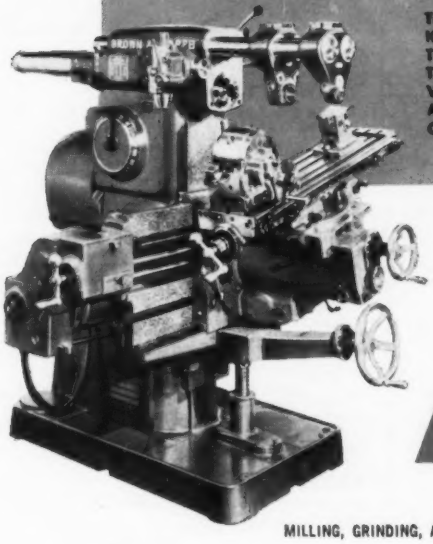


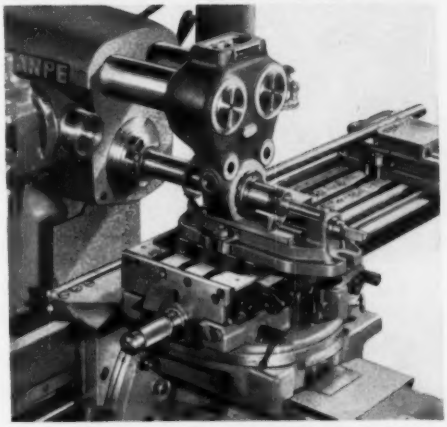
ALL in the day's work for the Brown & Sharpe OMNIVERSAL

The OMNIVERSAL provides the flexibility, work-range, and precision to handle *all* the milling operations called for in multi-operation work, at big savings in set-up time and cost. Get full information . . . write: Brown & Sharpe Mfg. Co., Providence, R. I.

FOR TOOLROOM
experimental, and prototype work
No. 0 OMNIVERSAL Milling Machine

Table feed	17"
Knee slide feed	17"
Total horizontal feed	34"
Transverse feed	5⅛"
Vertical adjustment	13"
Axial hand feed of Omniversal Milling Head,	2"



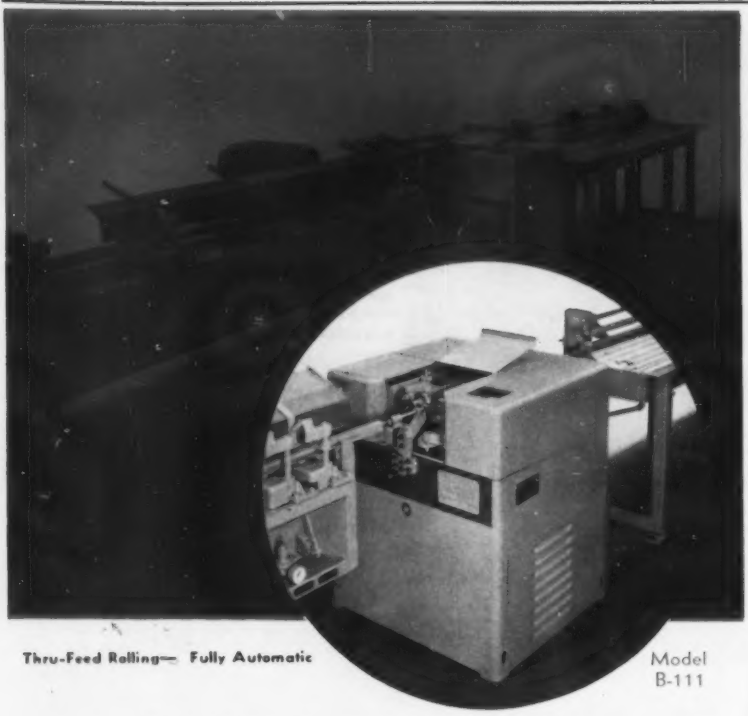


MILLING KEYWAY FULL 34" LENGTH of shaft. The exceptional longitudinal and vertical range of the OMNIVERSAL is another reason why its versatility is practically unlimited. Cuts up to 34" in length are made by combining feed of knee slide and table.

PROGRESS IN PRECISION FOR 125 YEARS

Brown & Sharpe

MILLING, GRINDING, AND SCREW MACHINES • MACHINE TOOL ACCESSORIES • PRECISION TOOLS • PUMPS • CUTTERS

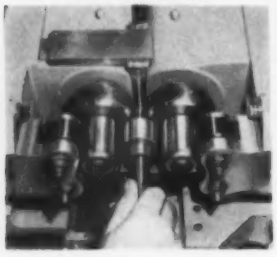


Thru-Feed Rolling— Fully Automatic

Model B-111

.... for Production or Job lot Threading and Form Rolling

In-Feed Rolling— Fully or Semi-Automatic



In-Feed Rolling— Manual loading

REED Two-Die Type Cylindrical Die Thread Rolling Machines

The flexibility of the Reed B-111 machine provides for the most economical selection of equipment to suit job lot or quantity production requirements.

Standard machines are available for in-feed or thru-feed rolling or a combination of both for a wide range of thread and form rolling applications. Precise micrometer die and work positioning adjustments assure continuous production of uniform accurate threads and forms.

Write for Machine Bulletin B-111-1

REED TRM-173

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

DIES, Blanking, Forming, Drawing, Extruding, etc.

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Rosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing

Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading

Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling

Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.

DISINTEGRATORS

Cincinnati Milling & Grinding Mchs. Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

DOWEL PINS

Allen Mfg. Co., Bloomfield, Conn.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
DoALL Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

DRAWING COMPOUNDS

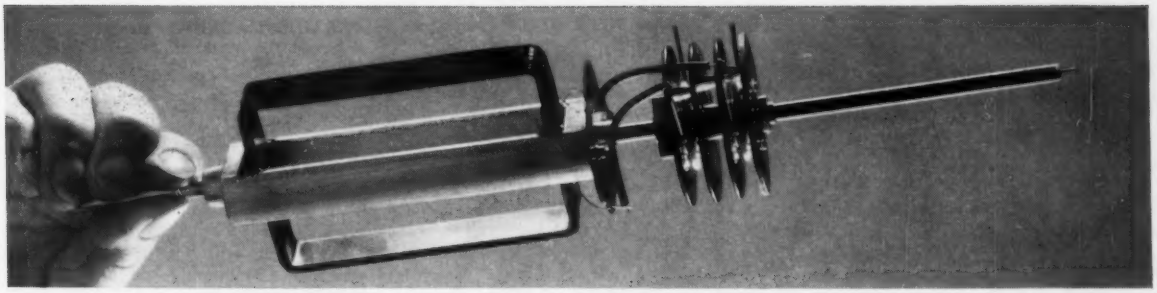
Oakite Products Inc., 26 Rector St., New York 6, N. Y.

DRESSERS, Grinding Wheel

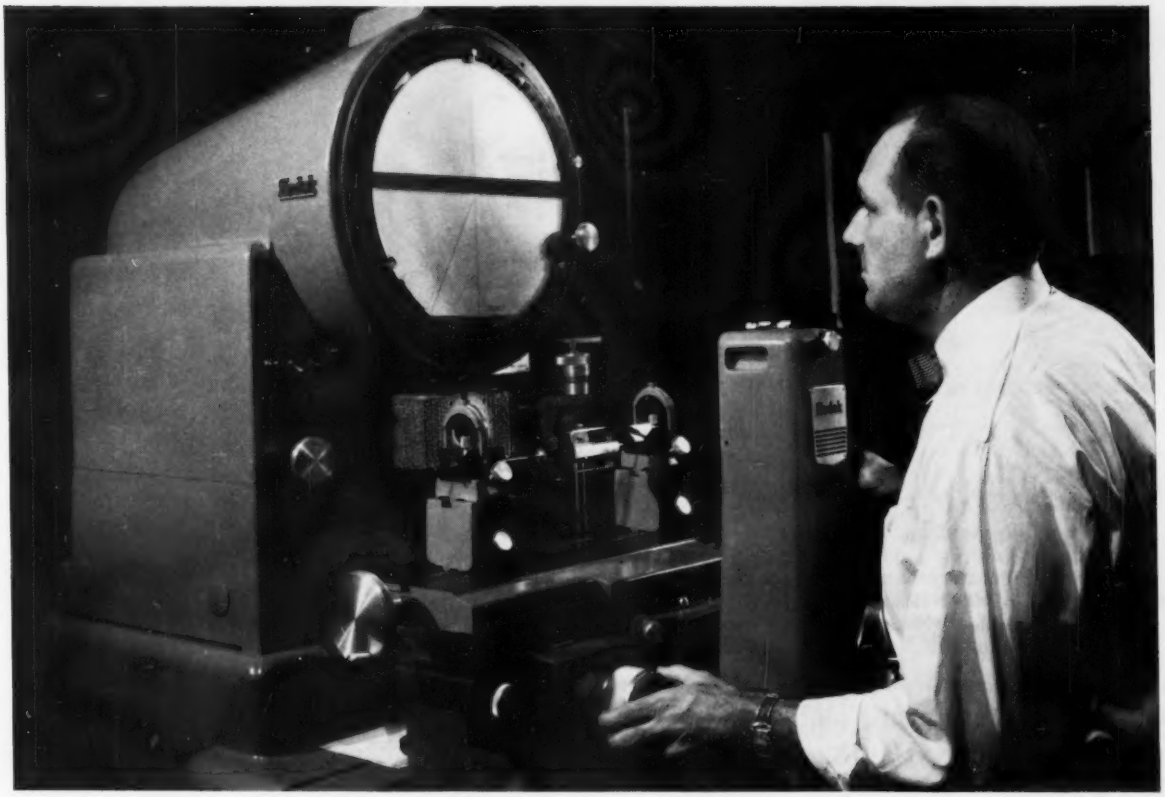
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DRIFT KEYS

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoALL Co., Des Plaines, Ill.



Before Westinghouse said "You can be SURE"...



they checked concentricity with this Kodak Contour Projector

What you see above is the moving element used in Westinghouse Type 44 electrical recording instruments.

Exact clearance between this element and the stationary elements is essential since these instruments often must be used in extreme temperature zones. This, along with the accumulation of tolerances in the complete assembly means that control of *concentricity* is vital.

You *could* check using surface plate, V-blocks, and height gage with clock indicator.

But Westinghouse checked concentricity with a Kodak Contour Projector. They saved time. They saved the cost of gages. They had *no* worries about damaging delicate parts because a beam of light exerts no pressure. And engineers were able to make corrections *before* production was started.

You, too, can be sure about effective, economical inspection with a Kodak Contour Projector.

The Model 14-5, shown in use at Westinghouse, is one of 6 models. They range from a portable, bench type model with 8-inch screen to the big 30-inch screen model.

Get all the facts. Write to:

Special Products Sales

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

For more data, circle this page number on inquiry card

DRILL HEADS, Multiple Spindle

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Delta Power Tool Div., 400 N. Lexington Ave., Milwaukee 10, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Jarvis Corp., Middletown, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois.

DRILL SLEEVES AND EXTENSION HOLDERS

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Automatic Tool Co., Richmond, Ind.
National Twist Drill & Tool Co., Rochester, Mich.

DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

DRILLING AND BORING UNITS, Self-contained

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Automatic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 12th St., Milwaukee 10, Wis.
Edlund Mchry. Co., Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 9th St., Hamilton, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.

DRILLING MACHINES, Deep Hole

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl & Eggleston Ave., Cincinnati, Ohio.
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Russell, Holbrook Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, St., Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.

DRILLS, Center

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

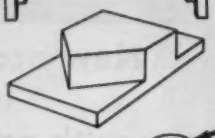
SLASH COSTS!

by machining on table of Contour-matic® BAND MACHINES

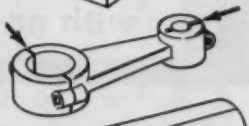
650% *faster cutting rate is the average*

40 hr. saved machining contours in this blanking die of HC-HC steel 3" thick.

5½ hr. saved machining to shape this shanked punch of Hi-Run tool steel.



6 min. saved per cut in parting connecting rods of forged 1025 steel.



45 min. saved per cut in splitting 3"-dia. manifolds of 347 stainless steel.

New Contour-matic band machines are unequalled for machining versatility and economy

- **Only machine providing effective use of high-speed steel saw bands.**
- **4-point support of cutting tool.**
- **Hydraulic work table with T-slots.**
- **In-built coolant facilities.**
- **Heavier, more rigid frame.**
- **Greater range tool velocity.**

Productive Maintenance is your assurance of continuous, profitable performance on all DoALL machines. It is an included service to DoALL users. Ask your local DoALL representative about "Package Service."

Contour-matic band machines are distinctively different. There is nothing else like them in the machining world. For machine tool replacements or additions, Contour-matic machines open entirely new possibilities for the reduction of machining cost. Even those jobs for heavy machine tools or expensive automatics are now in the range and capacity of the Contour-matic machine.

The phenomenal increase in cutting rate is accomplished by running the Demon® H.S.S. saw blade at from 50% to 150% higher velocity and with 15% to 25% greater work-feed pressure. This is impossible with other band saws using carbon steel blade.

Work large or small is now fed hydraulically and held by simple work fixtures mounted in table T-slots. Operator fatigue is reduced drastically.

Accuracy and finish of cut are held within thousandths through the machine's positive control over tool speed, tension, alignment, coolants and work feed. These are all coordinated to utilize the cutting ability, great beam strength and flex life of Demon H.S.S. saw blades.

Let us point out the work in your shop that can be done better and at lower cost on the Contour-matic machine. Call your nearest DoALL Sales-Service Store for a free in-your-plant demonstration.

B-53

This is a typical DoALL store

The DoALL Company, Des Plaines, Illinois

DRILLS, Deep Hole, Gun
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Oil Hole, Oil Tube
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Portable pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Ratchet
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Subland
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Twist, Carbide, Carbide-Tipped
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Wire
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio.

ELECTRICAL DISCHARGE MACHINES
—See Distintegrators

ELECTRONIC CONTROL SYSTEMS
Electronic Control Systems, 2231 S. Barrington Ave., Los Angeles 64, Calif.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXTRACTORS, Screw
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FASTENERS
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

New accomplishment in automation with new Logamatic 410

automated turret lathe with air-hydraulic cross slides

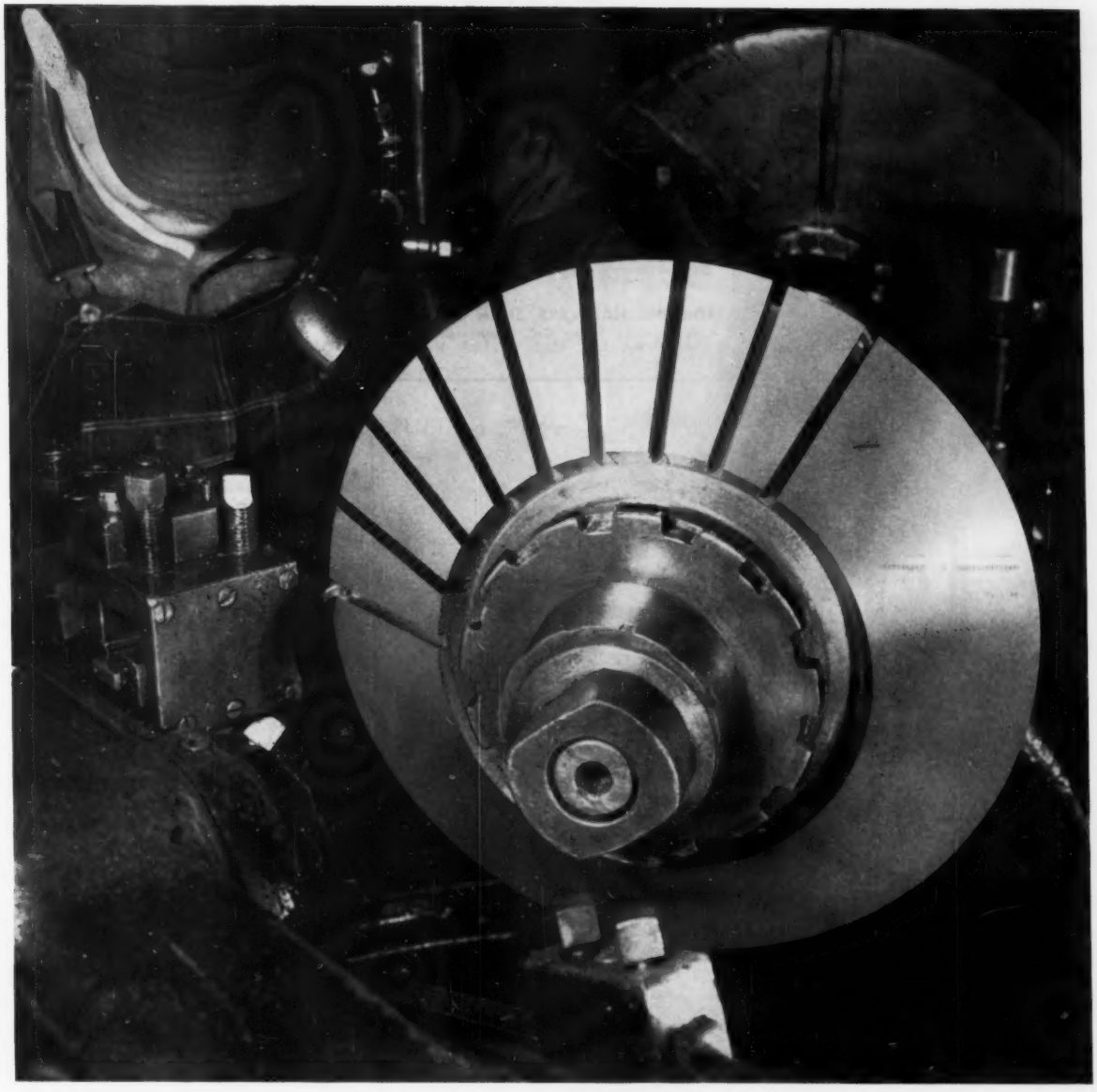
Only the Logan Logamatic 410 offers so many features in its price range! Swing over bed, 14⅝". Swing over cross slide, 6⅞". Spindle bearings: (4) ABEC Class 7. Speed range, 25 to 2,000 rpm. Two-speed, 3—1½ hp. Dinabrake motor and controls are standard equipment.

$8,800.00*

*F.O.B. factory, including motor and controls complete, less 8" power chuck accessory. Price subject to change.

- Electric power-turret feed
- Automatic cycling
- Adjustable rapid travel
- Variable-rate turret feed
- Variable-rate cross slide feed
- Variable-speed drive
- Push-button control
- Available as bar-feed machine
- L-0 spindle nose

LOGAN ENGINEERING CO. Dept. K-259, 4901 Lawrence Avenue, Chicago 30, Illinois



You can machine them with confidence

When gears are made from Bethlehem forged-and-rolled blanks, machinists often report faster progress and a better finished job. The blanks are so sound, and have such excellent grain flow, that even the "touchiest" machining can be done with confidence.

Asked what he likes best about these blanks, a veteran production man answered, "They're easy to machine. When you're cutting teeth, you need metal that's clean and solid all the way through."

But there's another important advantage—*strength*. Bethlehem's forging-and-rolling process, unduplicated anywhere, assures the high strength always needed for heavy-duty products. Because of this, the blanks are unsurpassed for gears, crane and sheave wheels, turbine rotors, flywheels, pipe flanges, and other circular parts. Available heat-treated or untreated, they can be furnished in sizes from 10 to 46 in. OD. Write for Booklet 216.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

For more data, circle this page number on inquiry card

FEEDERS, Automatic
Gear-O-Mation Div., Michigan Tool Co., 7171 McNichols Rd., Detroit 12, Mich.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
V & O Press Co., Hudson, New York

FILES, Band
DoAll Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoAll Co., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoAll Co., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

L&J

HIGH SPEED

Multi-Duty Press

OPTIONAL EQUIPMENT

Oil shield. Air clutch. Left or right fly wheel mounting. Variable speed drive. Automatic feed. Automatic misfeed stop. Accurate top stop. Push button or dial speed controls. Electric speed indicator. J.I.C. wiring. Automatic lubrication. Stroke length and shut height to fit the job. Bronze gibs, etc.

Straight Side Punch Presses
Single and Double Crank
Versatile, fast for volume production of small parts with large or progressive dies. 20 to 150 tons.

- A completely new No. 3½ — 27 ton — punch press that offers many advantages.
- Improved frame design gives greater rigidity for better accuracy and longer die life.
- Fully enclosed for extra safety and cleanliness.
- Speeds to 450 s.p.m. with 1" stroke (2½" standard — 4" maximum to order).
- Efficient at all speeds — on all jobs.
- Readily adaptable to special jobs at low cost.

NEW L & J CATALOG with complete specifications and construction features of 23 O.B.I. punch presses in geared and non-geared types from 14 to 90 ton capacities. Also, Straight Side Punch Press. *Write for your copy now.*

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FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

FORGING, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.

FORMING MACHINES, Cold-Rolling
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

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DRILLS - TAPS - REAMS . . .
a machinist's DREAM!!

A REALLY NEW MACHINE

THAT –

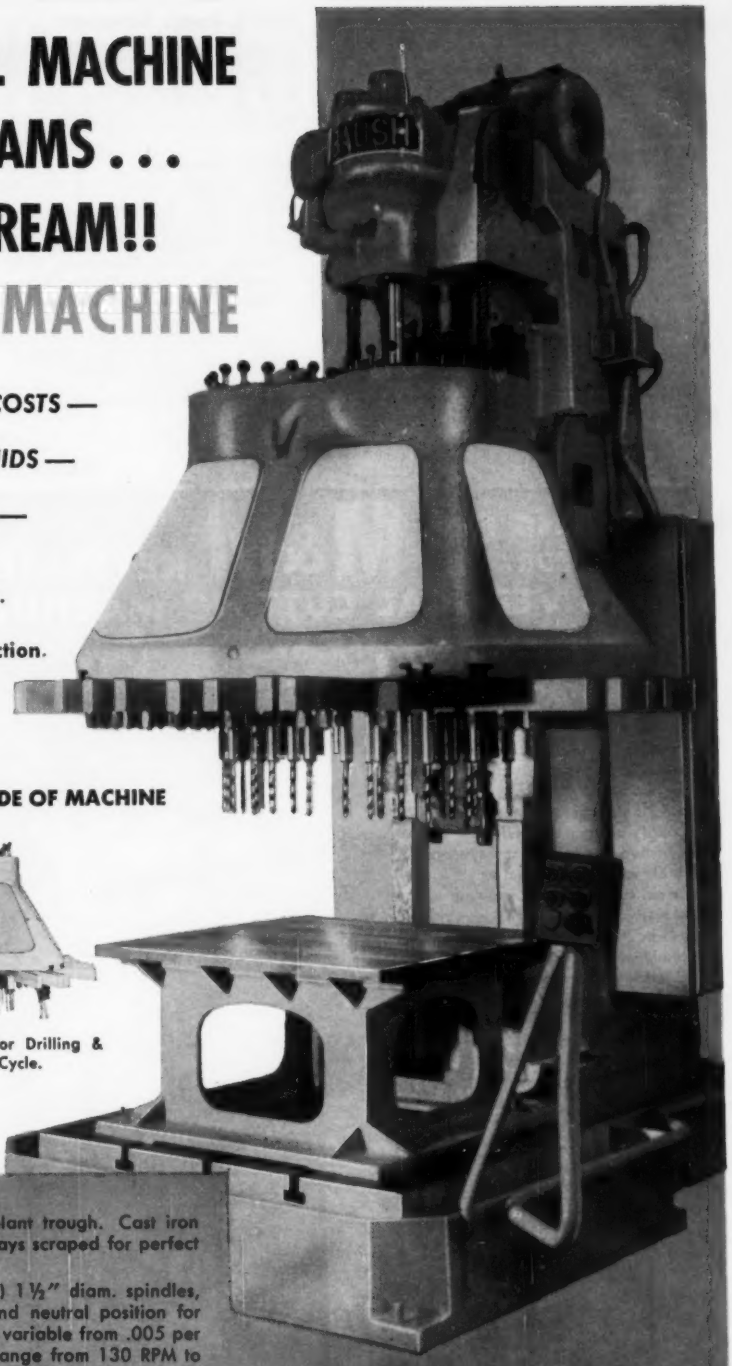
CUTS INDIRECT MAINTENANCE COSTS —
Your own mechanics maintain unit.

HAS NO COSTLY HYDRAULIC FLUIDS —
No troublesome leaks to locate.

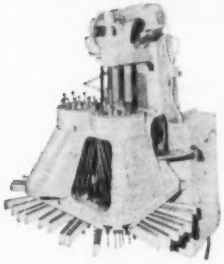
INSURES STEADY, POSITIVE FEED —
Insures greater tool life.

ELIMINATES SURGE —
Even on breakthru. No tool breakage.

3 DIFFERENT CYCLES —
Completely automatic for high production.
Semi-Automatic for low production.
Jog cycle for set-up work.

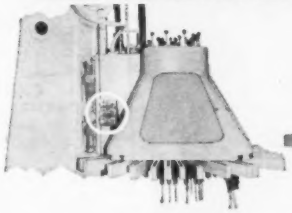


TOP OF HEAD



Two Independent Spindle Speeds and Neutral position on each Spindle controlled by knobs.

LEFT-HAND SIDE OF MACHINE



Control for Drilling & Tapping Cycle.

SPECIFICATIONS:

Heavily ribbed cast iron base has large coolant trough. Cast iron column is ribbed, and accurately machined ways scraped for perfect head alignment.

27" x 40" Rectangular Head, bored for (32) 1½" diam. spindles, with two (2) independent spindle speeds, and neutral position for each spindle when not in use. Spindle speed variable from .005 per rev. low, to .090 per rev. high, with speed range from 130 RPM to 1050 RPM. Feed is thru ball screw with minimum friction from spindle drives. Rapid head traverse accomplished with 1 HP. Motor. Electric brake holds lead-screw and shuts off motor when head goes from rapid traverse to feed stroke. Spindle drive rotates on a ball nut on locked lead-screw to give pre-set feed for tool. Spindles are slip-sleeve, adjustable arm type, used with master-bored cluster plate. 2 to 1 Spindle speed ratio.

Lubrication can be manual or automatic. Electric controls are J.I.C.

Motors:
1-20 HP 1800 RPM for spindle drive
1- 1 HP 900 RPM for rapid traverse.

Floor space 88" x 56" Weight 18000 lbs.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

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GAGES, Automatic Sorting

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper Telescoping Thickness

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

GAGES, Multiple Inspection

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett, The L. S., Co., Athol, Mass.

GASKETS

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.

GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd. Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Bevel and Spiral

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

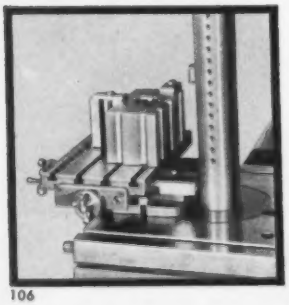
(Continued on page 258)

AMAZING NEW HYDRAULIC **M&M** KEYSEATER AND VERTICAL CUTTING MACHINE

does the work of many machines

In addition to a keyseater that cuts internal keyways up to 3" wide x 24" long, the new hydraulic M & M is a handy tool room machine and can be easily adapted to special production jobs other than keyways. A wide variety of internal or external cuts, serrations, grooves and teeth can be rapidly made on this machine. With a combination tilting table and index table (shown on machine at right) straight or tapered bores and accurately spaced multiple keyways or splines may be cut at any degree of the circle. Send us prints of your cutting problems.

Right: Set-up for internal cutting
Below: Set-up for external cutting



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BUILDERS OF MACHINERY SINCE 1854

M&M KEYSEATERS AND VERTICAL CUTTING MACHINES

MITTS & MERRILL • 64 Holden St. • SAGINAW, MICHIGAN

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FINEST IN FIT, FEEL AND FINISH

WILLIAMS NEW DESIGN SUPERRENCHES®

Fit Square, precision broached openings end sloppy fits and rounded nuts. Strong but thin heads permit plenty of clearance in tight quarters.

Feel Drop-forged alloy steel allows trim heads and slim handles designed to give the same "balanced feel" in all sizes . . . all styles.

Finish Smooth contours and satin finished handles provide a safe and sure grip. Opening sizes legibly stamped. Chrome plated over nickel.

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DROP FORGED
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667 stock sizes of Bunting Sintered oil-filled Bronze Plain, Flange and Thrust Bearings. Made to ASTM Standards.
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343 sizes of Electric Motor Bearings for all makes and sizes of electric motors from 1/50 to 100 HP.

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Emergency machine shop service is maintained in all Bunting Branches for quick alteration of stock items for emergency maintenance applications.

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS
American Schiess Corp., 1232 Penn. Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

GEAR LAPPERS
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.

GEAR MOTORS—See Speed Reducers

GEAR RACKS
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

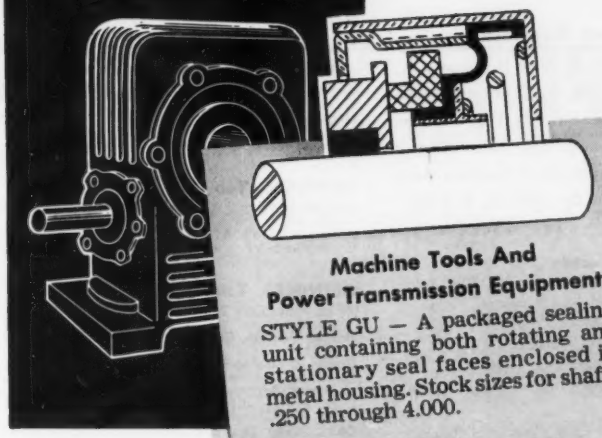
GEAR SHAPERS
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Nonmetallic
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

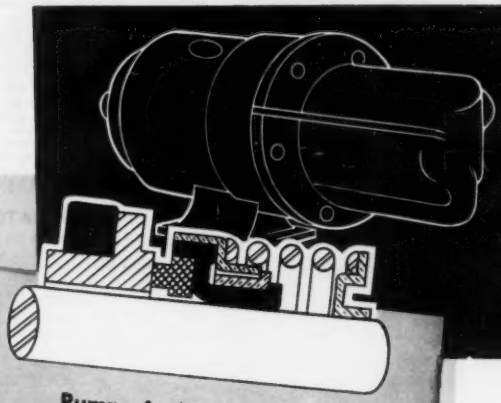
GEARS, Cut
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio.

(Continued on page 260)



Machine Tools And Power Transmission Equipment

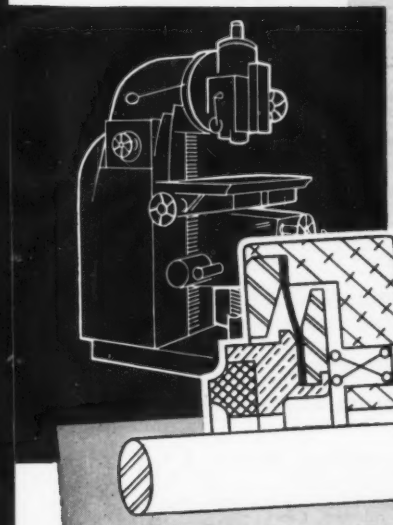
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

A Complete Line

GITS SHAFT SEALS

For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

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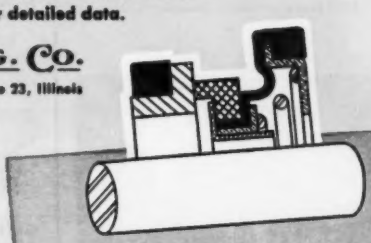
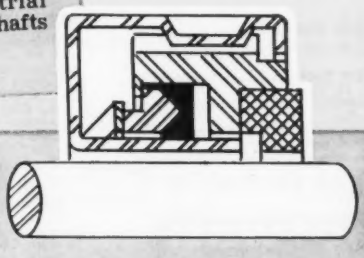


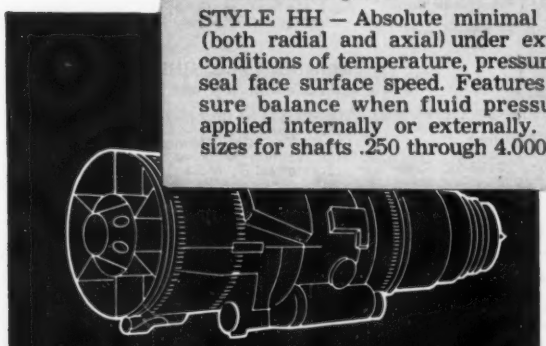
Household Appliances

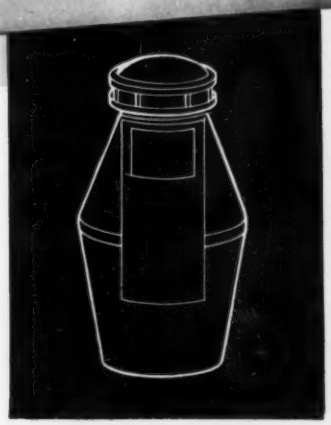
STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.





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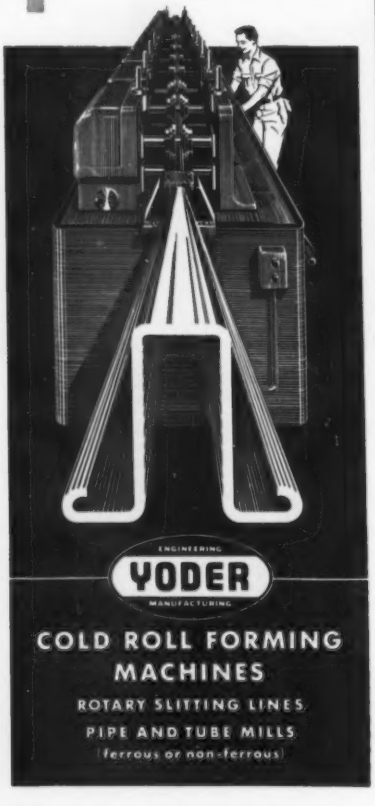

Horsburgh & Scott Co., 5114 Hamilton Ave., Cleveland 14, Ohio
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

GENERATORS, Electric

Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Carbide Tool

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold

Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee, Adrian, Mich. (also drill point thinner)
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.

GRINDERS, Face Mill

Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St. Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDERS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.

GRINDERS, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost

Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Broach

Gallmeyer & Livingston Co., 336 Straight, S. W. Grand Rapids 2, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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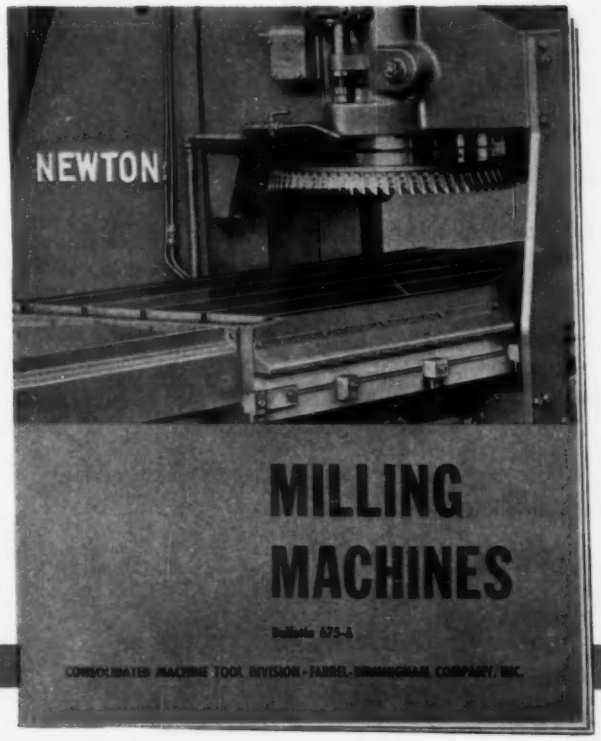

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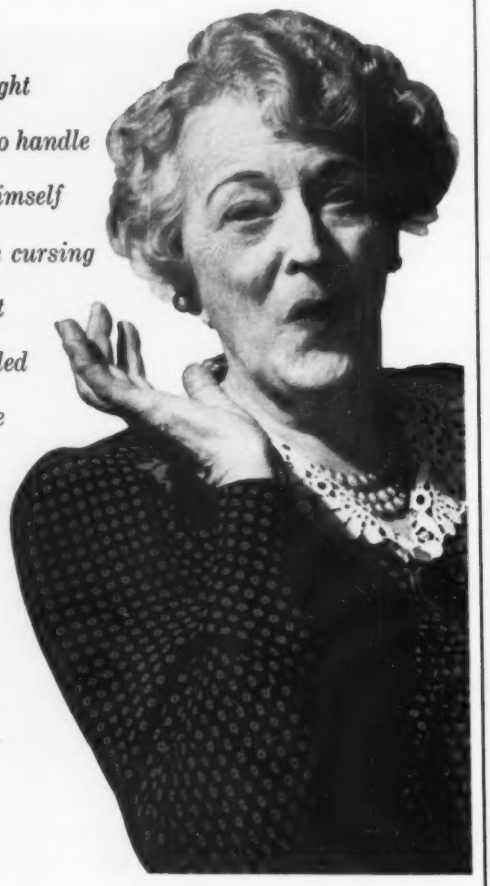

You'd have thought Herbert actually had to handle those dirty old gears himself the way he'd come home cursing and mumbling about "rejects" and "added costs". But this is the third night this week he's taken me out for dinner! I'd certainly like to meet that CINCINNATI person!

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Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES—Jig

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoALL Co., Des Plaines, Ill.
Gallmeyer & Livingston Co. 336 Straight, S.W. Grand Rapids 4, Wis.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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52100

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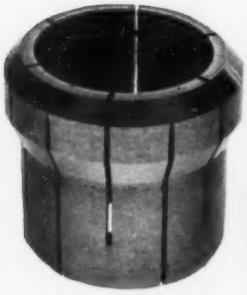

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WHY MICROHONING*

OF GUIDE PIN BUSHINGS ASSURES FUNCTIONAL PRECISION, LONGER LIFE, LOWER COSTS

Lamina Dies and Tools, Inc., a pioneer in the development of bronze-plated guide pin bushings (bronze is electroplated on hardened steel for combined strength and smoother action), required a processing method that would economically produce bushing bores having dimensional precision, accurate geometry, functional surface characteristics, and consistent duplication to exacting specifications in every bushing.

In developing processing methods for the bushing bores, Lamina engineers found that Microhoning is best for generating final precision and functional surface characteristics at lowest cost per bushing.

Bronze, bronze-plated or steel bushings from ¾" to 4½" in diameter are Microhoned on this Hydrohoner. Stock removal is from .001" to .003" and average unit cycle is 30 seconds. Machine is equipped with automatic size control and tool expansion.

Characteristic cross-hatch lay pattern

Why? Because Microhoning generates a round, straight cylinder along the neutral axis of the bore; size and geometry of bushings up to 2½" in diameter are held to .0001" tolerances; contact area between bushing and guide pin is 25% greater than obtainable by other final processing methods. In addition, the characteristic cross-hatch lay pattern generated by Microhoning provides a "built-in" lubrication system in each bushing bore. This combined with the clean-cut surface prevents seizure or scuffing during operation of bushing. Finally, the self-dressing action of Microhoning abrasives assures continuous cutting efficiency and identical geometry, dimensions and surface finish in every bushing bore.

Thus, Lamina realizes, through Microhoning's generation of quality surfaces and precision bores, the full performance potential of bronze, bronze-plated or steel guide pin bushings—longer life, smoother action, lower costs.

Learn how Microhoning provides efficient stock removal, closer tolerances and functional surfaces—SEND FOR FREE LITERATURE.

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Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Walker, O. S. Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Majestic, Inc. 147 Joseph Campau, Detroit, Mich.

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Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS
Bay State Abrasive Co., Westboro, Mass.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngtown, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GROOVING TOOLS, Internal
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS, Portable Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS, Power
Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.

Erie Foundry Co., 1253 W. 12th St., Erie Penna.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio.

HARDNESS TESTERS
Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.

HEAT-TREATING EQUIPMENT — See Annealing Furnaces, Flame Hardening Machines, Induction-Heating Equipment

HOBS
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HOISTS, Electric
Ingersoll-Rand Co. 11 Broadway, New York 4, N. Y.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HONING MACHINES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-120th St., Moline, Ill.
Superior Hone Corp., 1623 Elreno St., Elkhart, Inc.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

HONING STONES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

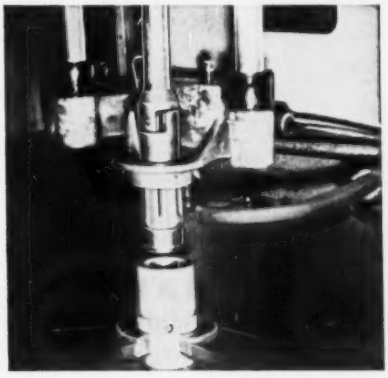
HOSE
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

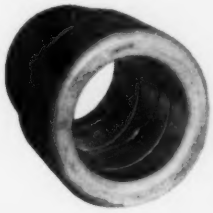
HYDRAULIC MACHINERY
Tools and equipment
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., E. W. Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Northern Hydraulics & Mch. Corp., Melrose Park Ill.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HOW MICROHONING* OF GUIDE PIN BUSHINGS PROVIDES FUNCTIONAL PRECISION, LONGER LIFE, LOWER COSTS

HERE'S HOW Lamina Dies and Tools, Inc. uses Microhoning to generate final precision and functional surface characteristics in bushing bores at minimum cost.

Microhoning's low-velocity, controlled abrading technique removes a minimum of the bronze plating to obtain accuracy and functional surface characteristics. Thus, as much as possible of bronze plating is conserved and a uniform thickness of bronze throughout the bore is assured.





Above is a typical Lamina guide pin bushing. These bushings range in diameter from ¾" to 4½". An air operated, three-jaw fixture rigidly holds the work piece and is easily adapted to bushings of any size.

Because Microhoning tools have universal joints, they follow the neutral axis of the bore in generating round, straight cylinders. Since the bore location remains unchanged, concentricity between bushing I.D. and O.D. is obtained.

The combined reciprocating and rotating motions of the Microhoning tool creates on the bore surface a cross-hatch lay pattern that functions as a "built-in" lubricating system. For, the multitude of minute, diamond-shaped plateaus—over which the load is evenly distributed—are separated by a network of valleys that holds the lubricant. This better method of lubrication plus the clean-cut Microhoned surface prevent seizure or scuffing of bronze, bronze-plated and steel bushings. And, the self-dressing action of Microhoning abrasives maintains cutting efficiency to assure the same surface finish is developed in every bushing bore.

Learn how Microhoning provides efficient stock removal, closer tolerances and functional surfaces—SEND FOR FREE LITERATURE.

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MICROMATIC HONE CORP.
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The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to machine at all angles with one set-up.

VERIFIED ACCURACY— Before it leaves the factory each CLAUSING Mill must pass rigid tolerance tests such as:

1. Top of table perpendicular to column ways within .0005" in 6" travel.
2. T-slots square with cross slide dovetails within .0005".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

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Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Vinco Corp., 9111 Schaefer Highway, Detroit.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, L. S. Co., Athol, Mass.

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Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
Starrett, The L. S. Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th & N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St. Milwaukee 4, Wis.

JACKS, Planer—See Set-up Equipment

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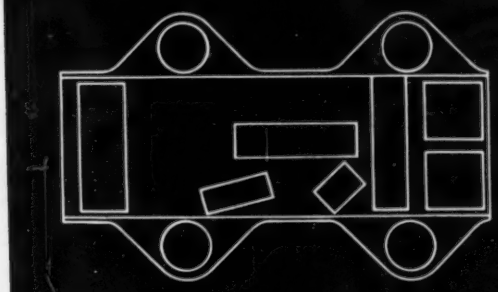

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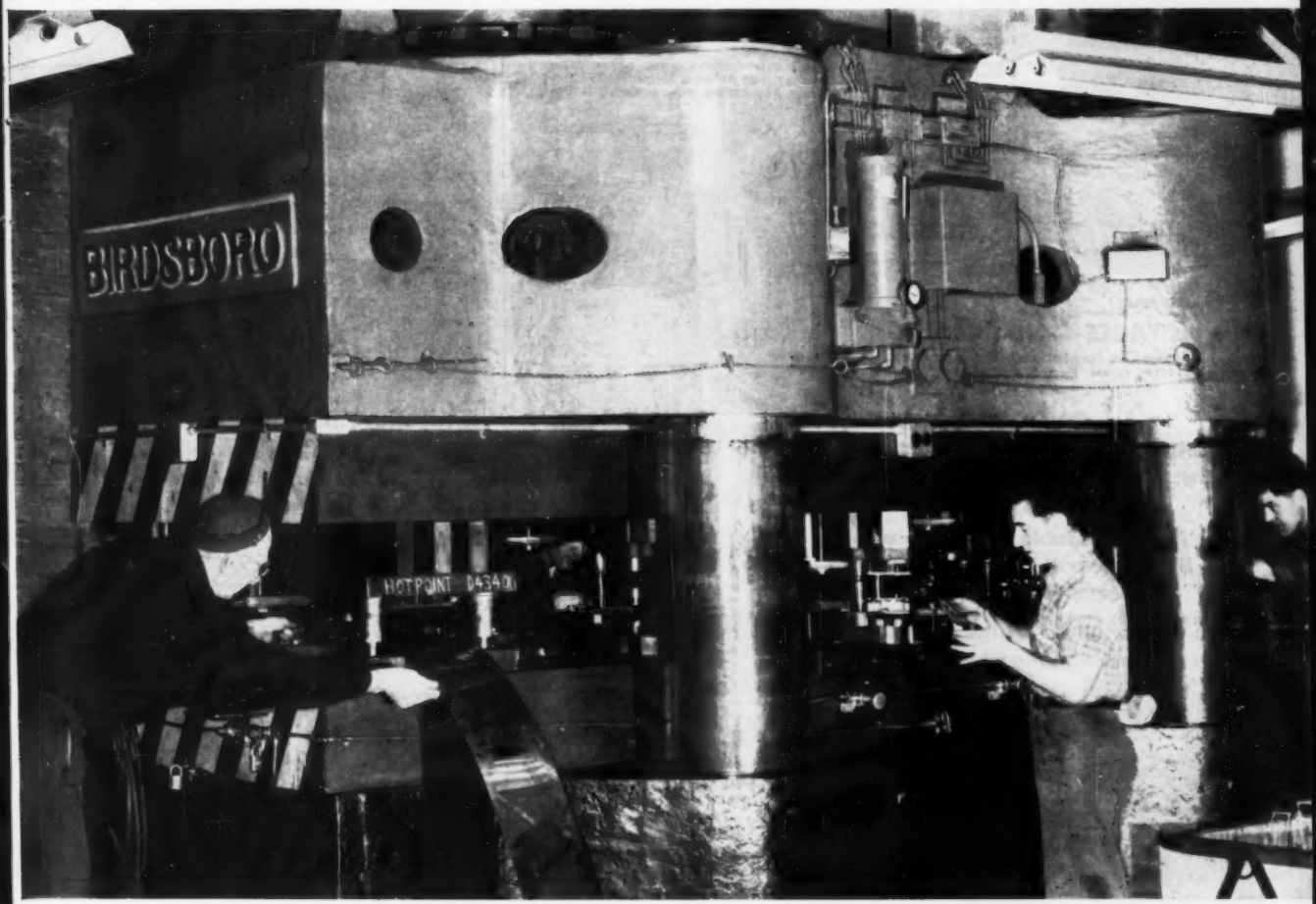

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AS STANDARD EQUIPMENT

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BECAUSE . . . Marvels are protected and of sound construction to give long life and efficient filtration.

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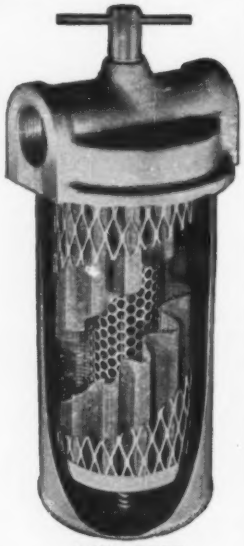

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Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Il.

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
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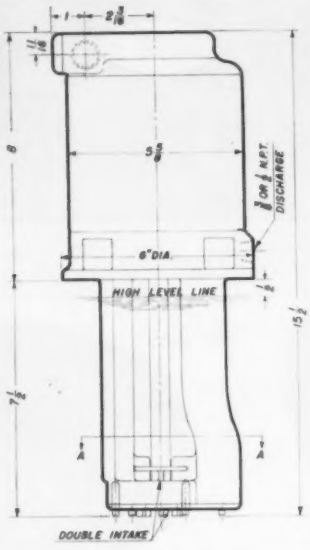

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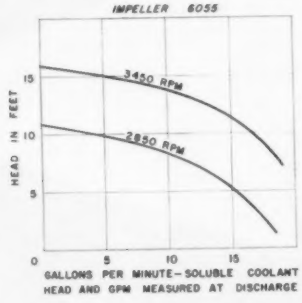

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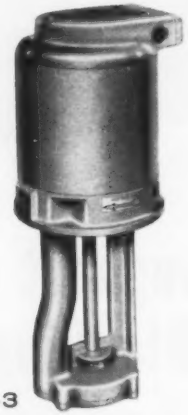

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Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

LATHES, Duplicating
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Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

LATHES, Engine, Manufacturing
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Atlas Press Co., Kalamazoo, Mich.
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Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
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Atlas Press Co., Kalamazoo, Mich.
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Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerai Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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LATHES, Gap
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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

LATHES, Hollow Spindle
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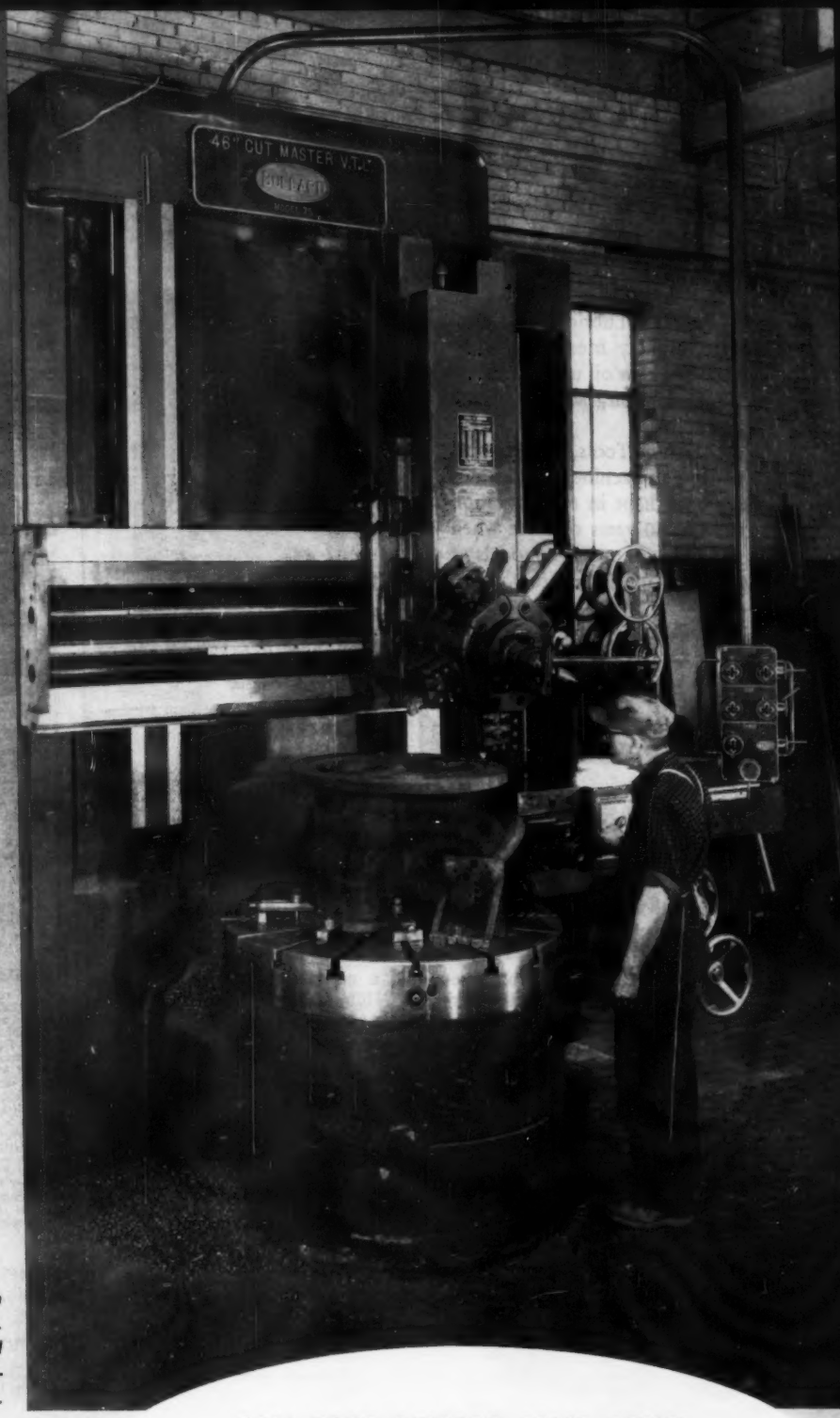

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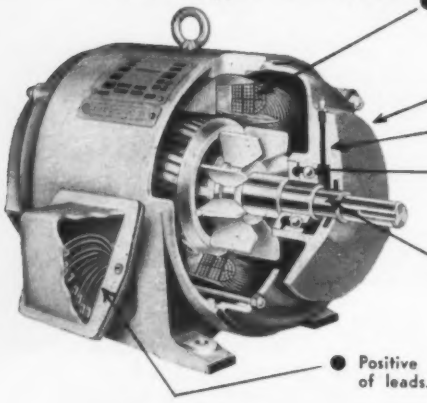

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Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City, 2, N. J.

LATHES, Speed, Second-operation

Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundreis, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type Saddle Type

Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret, Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Starrett, L. S., Co., Athol, Mass.

LEVELS

Starrett, The L. S., Co., Athol, Mass.

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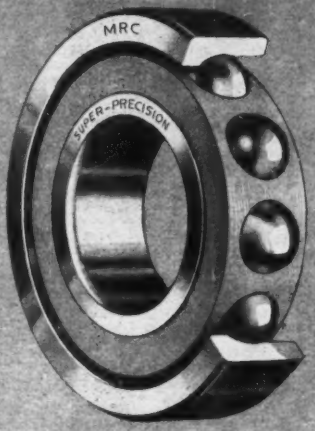
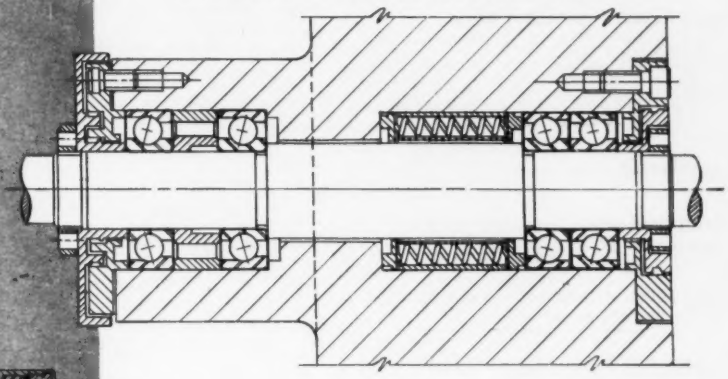
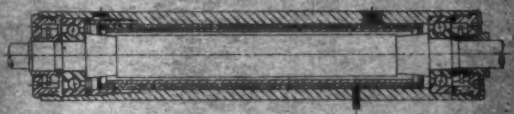
(*Continued on page 274*)

Long life accuracy

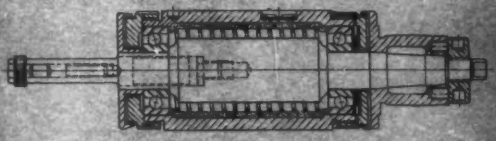
IN MACHINE TOOL SPINDLES with M-R-C SUPER-PRECISION BALL BEARINGS





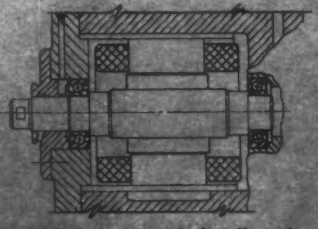


Grinder Spindle



Internal Grinder

Surface Grinder



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Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Sheffield Corp., 721 Springfield St., Dayton, 1, Ohio

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DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
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Starrett, The L. S., Co., Athol, Mass.

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DoALL Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
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Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Consolidated Machine Tool Corp., Rochester, N. Y.
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Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
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Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
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Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

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Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
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Snyder Tool & Engrg. C., 3400 E. Lafayette, Detroit 7, Mich.
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Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
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Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

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Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Turret
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

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Atlas Press Co., Kalamazoo, Mich.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
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Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

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Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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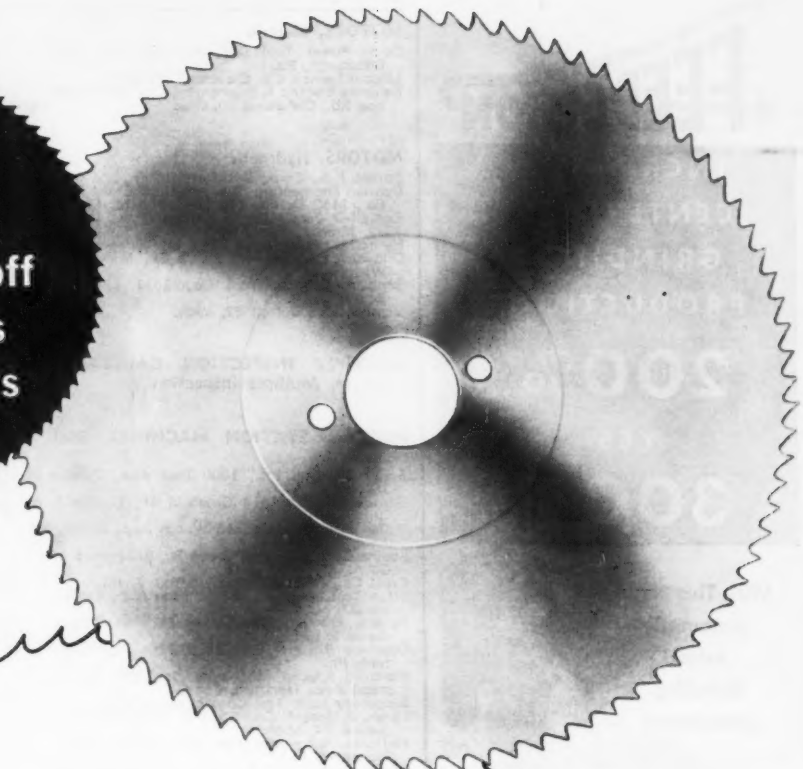
M&M blade speeds up cut-off of soft metals and their alloys



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A *Availability*

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Cross Co., 3250 Bellevue, Detroit 7, Mich.
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Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
National Automatic Tool Co., S. 7th N. St. Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

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Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
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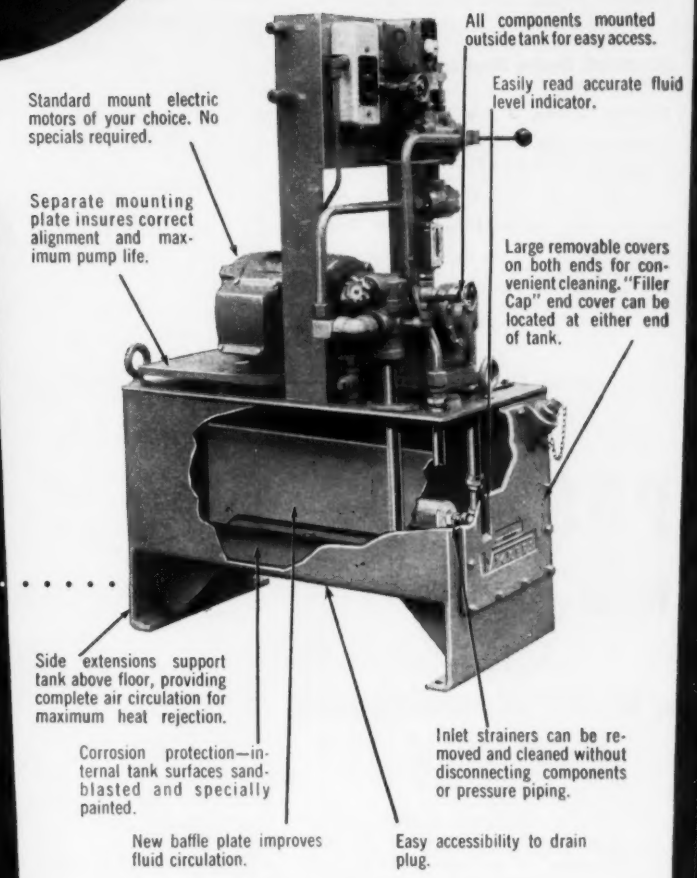
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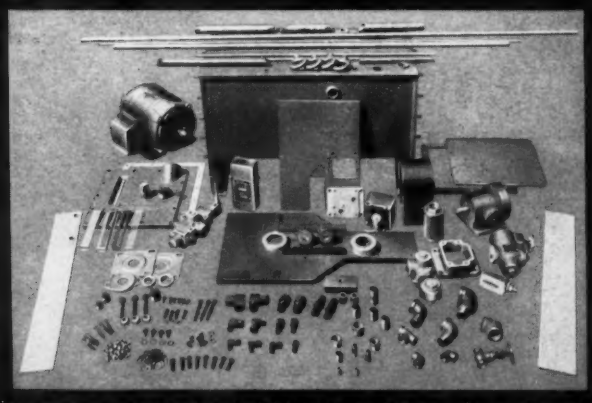

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from to in seconds

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Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.

PRESSES, Assembling

Allen, Alva Industries, Clinton, Missouri
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Denison Enginering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Northern Hydraulics & Mach. Corp., Melrose Park, Ill.

PRESSES, Blanking, Stamping

Allen, Alva Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E. Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 8th St., Ampere, East Orange, N. J.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
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Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.

(Continued on page 280)

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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
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Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
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Chambersburg Engineering Co., Chambersburg, Pa.
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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

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Allen, Alva Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
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L & J Press Corp., 1631 Sterling Ave., Elkart, Ind.
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PRESSES, Extrusion

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Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Pa.
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PRESSES, Foot

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Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
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Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio.
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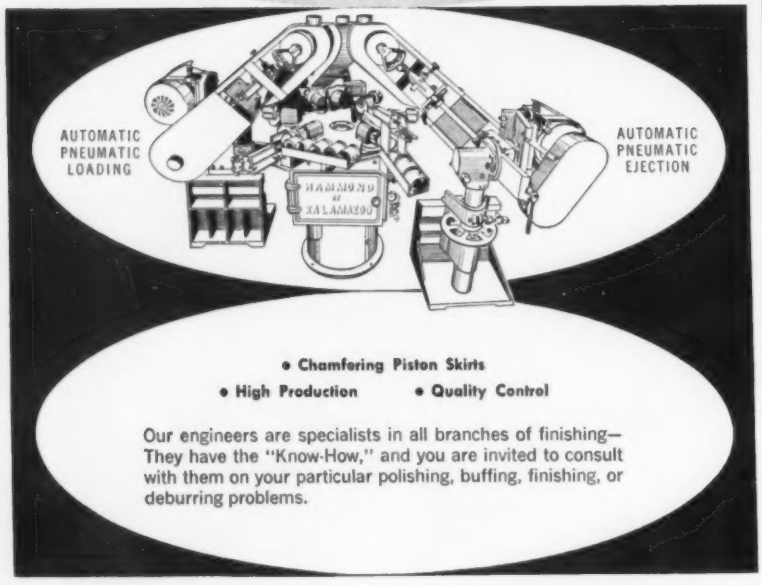

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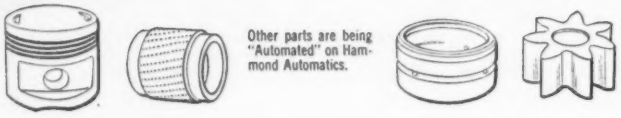

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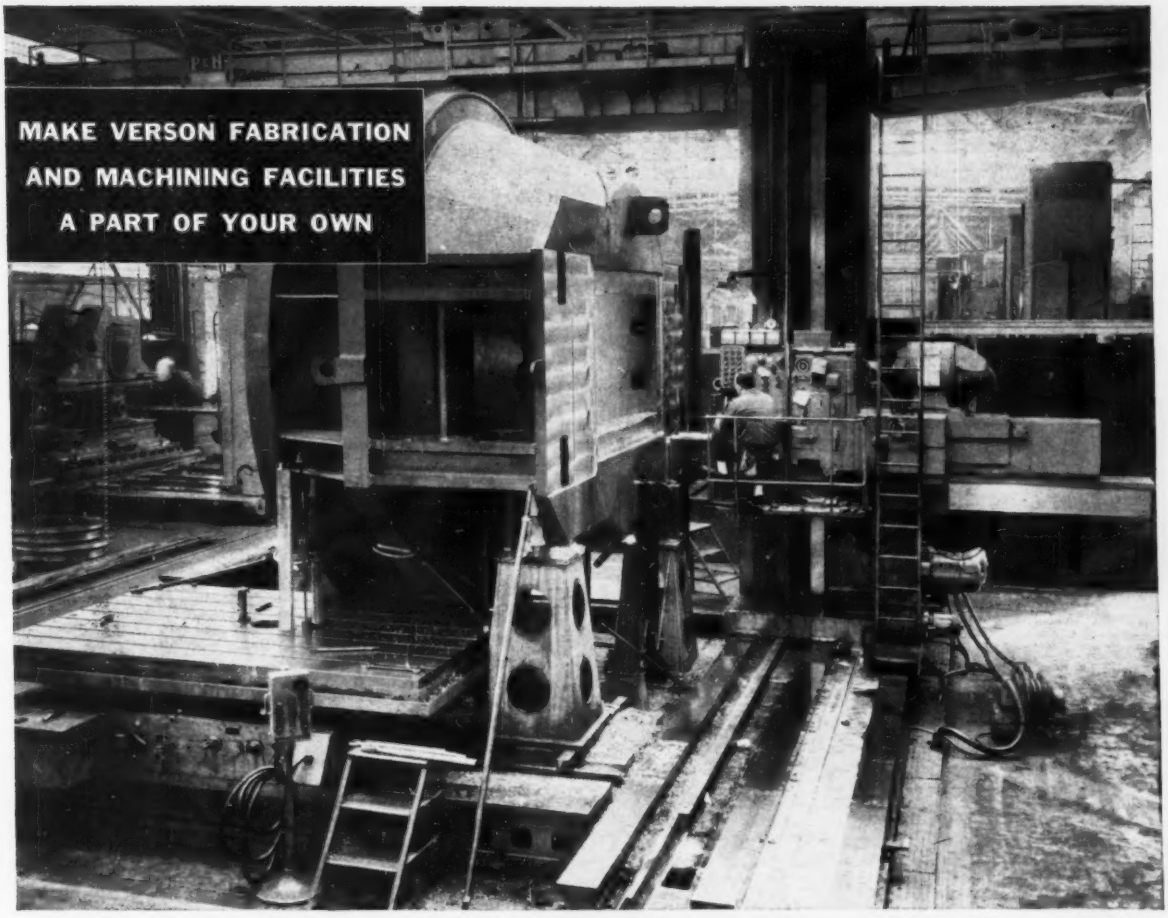

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Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
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Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
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Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
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Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
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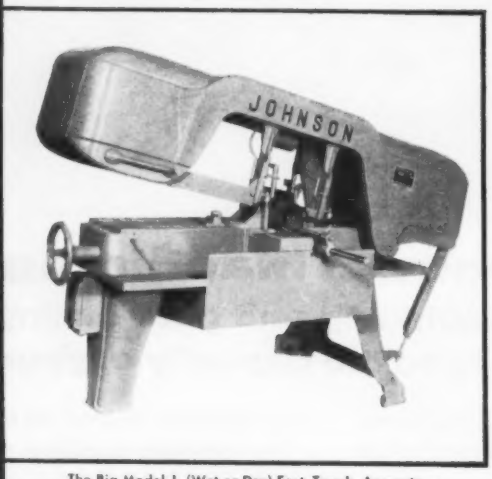

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Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9303 S. Kenwood Ave., Chicago 19, Ill.

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
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Ingersoll-Rand Co., Phillipsburg, N. J.
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Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 2, Ohio

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American Engineering Co., Wheatsheaf Lane & Sepviva St., Philadelphia 37, Penna.
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Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
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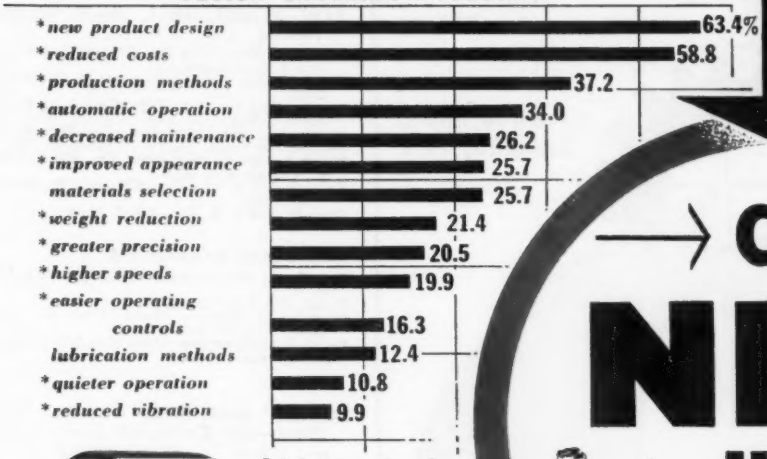

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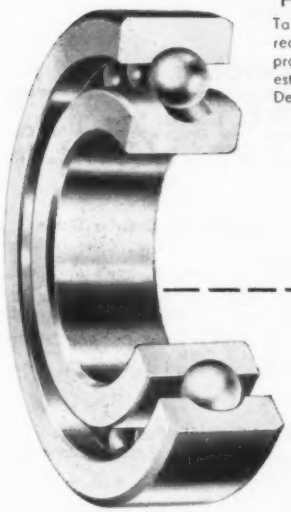

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Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jarvis Corp., Stack Ave., Middletown, Conn
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

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Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

RIVETERS, Stationary
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Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

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SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

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Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
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DoALL Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

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Cutron Mfg. Co., Lubbock, Texas
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.

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Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Ty-Sa-Man Machine Co., Inc., Knoxville, Tenn.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

SAWS, Screw-slotting—See Cutters, Milling

SCREW DRIVERS, STUD AND NUT SETTERS, Power
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
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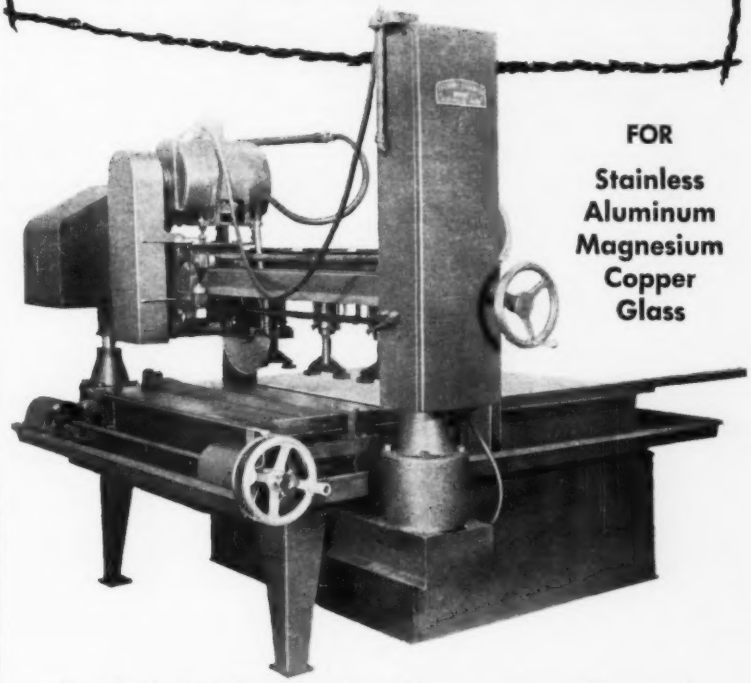

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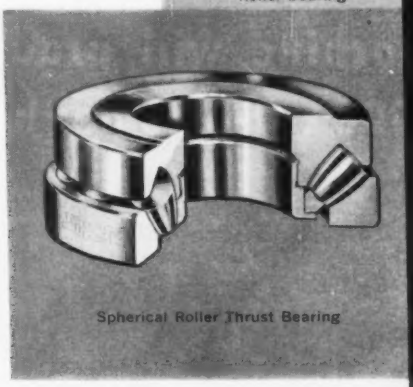

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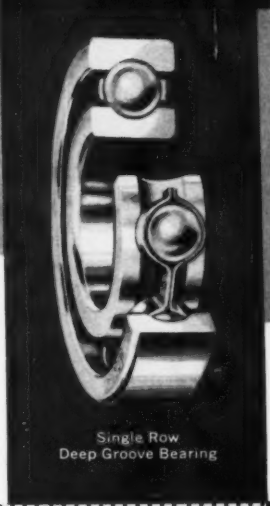

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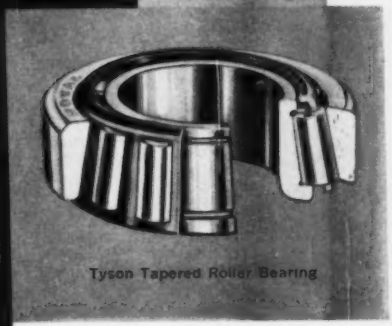

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Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Numatics, Inc., Milford, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Electric Valve Div., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Hydraulic Press Mfg. Div., Mount Gilead, Ohio.
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

WELDING EQUIPMENT, Arc
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Gas
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Resistance
Eisler Engrg. Co. Inc., 750 South 13th St., Newark, N. J.
Federal Mch. & Welder Co., Warren, Ohio.

WELDING POSITIONERS
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

WELDMENTS
Bliss, E. W. Co., Canton, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIRE
Allegheny Ludlum Steel Corp., Pittsburgh, Pa. (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.

WIRE FORMING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

WOODWORKING MACHINES
Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.

WRENCHES, Allen, End, Socket, Adjustable, etc.
Allen Mfg. Co., Bloomfield, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

Helical
GEARS AND PINIONS

SPURS TO 72" PD. 1 DP
BEVELS TO 54" PD. 1 DP
SPIRAL, HELICAL and WORM GEARS TO 48" PD. 2 DP
CONTINUOUS-TOOTH HERRINGBONE TO 60" PD. 2 DP
SPROCKETS TO 72" PD. 2½ DP
RACKS TO 20 FT. LONG. 3 DP
SILENT GEARS: RAWHIDE, BAKELITE, FIBROIL
HEAT-TREATED, CASE OR FLAME HARDENED GEARS—OF CARBON OR ALLOY STEEL

Ready for long, trouble-free use in bar straightening equipment, these precise examples of Stahl's craftsmanship in gear fabrication have been double-checked for strict compliance with specifications. Illustrated are 4 steel helical gears—24.697" P., 72 T., 3 D.P., together with 2 Hyten B3X steel shaft pinions 6.758" O.D., 16¾" F., 35" Length-over-all. Heat treated. Let Stahl end your gear worries—send for our estimate.

Stahl
GEAR & MACHINE COMPANY
3901 HAMILTON AVENUE
CLEVELAND 14, OHIO

For more data circle item 701 on Inquiry Card

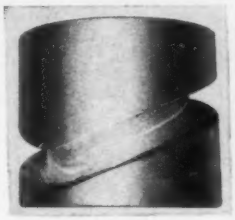
YOU'D BE LATE, TOO, if you had the trouble I've had in my toy shop. We never had such a demand—rockets, space ships, burp guns—I thought we'd never make enough. You can bet that we'll use Threadwell Cutting Tools next year so our production will run smoothly. And can you imagine . . . those wiseguy reindeer want overtime. *Photo by Cobb Shinn for Threadwell Tap & Die Co., Greenfield, Massachusetts.*

For more data circle Item 702 on Inquiry Card

Rowbottom for Cams

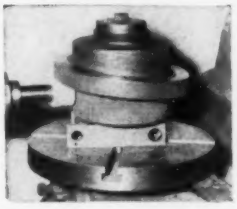
How a Cam was turned "Inside-Out"

The customer's requirements called for finer adjustment of the mechanism in which the cam labelled "Before" was being used on a nylon winding machine. In this cam only one roll was used to run in the groove of the cam. Exactly the same motion was accomplished in the cam labelled "After" by literally turning the cam inside-out and employing two rolls to run on opposite sides. Requirements as to adjustment were fully met.



BEFORE:
"Female" Cam using only one roll.

Jobs like this are every day problems faced and met by Rowbottom. Perhaps you have a problem in cam production which comes within the scope and experience of Rowbottom. It may well be worth your while to submit your requirements. Send us your specifications. Ask for an estimate on any type cam in any quantity; also on rotary profiling.



AFTER:
"Male" Cam using two rolls.

The ROWBOTTOM MACHINE CO.
WATERBURY, CONN.

For more data circle Item 703 on Inquiry Card

INSPECTION BY PROJECTION

with the *NEW* **SCHERR MICRO PROJECTOR** with the **VERTICAL DESIGN**

NEW IMPROVED *Self-Contained* MODEL

featuring

Rigid Floor Base — eliminating extra charge for table

Tilting Stage for Helix, Angles and Bevels

4" Dia. Stage Opening

14" Diameter Screen

Column Slide adjustable for wear by means of gibs. Will hold square indefinitely.

Custom made Precision Coated Lenses and double condensers for different objectives 10 to 100X magnification.

Surface Illuminator can be added anytime.

An entirely new practical designed tool for Inspection Department and Production Shop.

BASIC PRICE . . . $450.00

SCHERR PRECISION COMPARATOR CHARTS

OVERLAY and REPLACEMENT STANDARD CHARTS are carried in stock.

SPECIAL CHARTS made up to your specifications.

WRITE FOR ILLUSTRATED FOLDER — CODE 5/61/Y

GEORGE SCHERR CO., Inc.
200 MA LAFAYETTE STREET • NEW YORK 12, N. Y.

For more data circle Item 704 on Inquiry Card

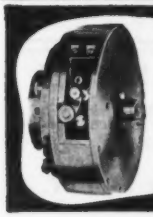
GEARS —ALL MAKES . . . Special and standard

PRECISION GEARS UP TO 200 DIAMETRAL PITCH

All Gears certified for Accuracy Quality and Fine Workmanship

NEW JERSEY GEAR & MFG. CO.
1470 Chestnut Ave. **Hillside, N. J.**

For more data circle Item 705 on Inquiry Card



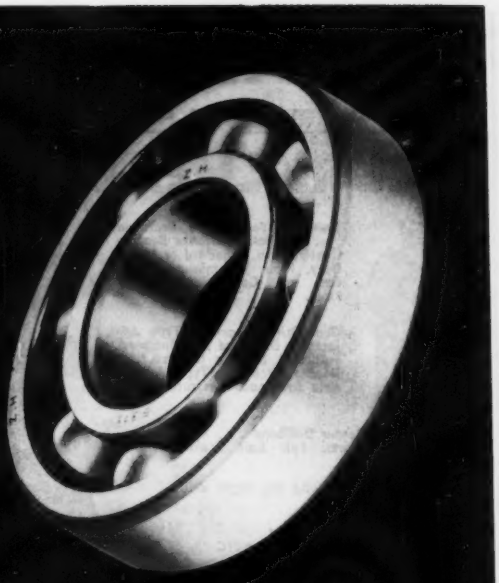
IMPROVE FACING OPERATIONS

ON BORING MILLS - DRILLS - LATHES MILLERS AND RADIALS

M-D facing Head feeds automatically. Lathe tool bit travels radially from center outward or reverse. 10 sizes, 6" to 46" dia. Write for bulletin, prices.

MUMMERT-DIXON CO. 126 Philadelphia St. HANOVER, PA.

For more data circle Item 706 on Inquiry Card



QUALITY BEARINGS

MEAN LONGER LIFE & GREATER PROSPERITY

The most essential factors in any bearing are precision and durability . . . and bearings guaranteed for precision and durability are those exported by the Japan Bearing Export Company. JBEC is an export organization established jointly by Japan's four largest bearing manufacturers. It is the sole exporter of the highest quality bearings produced by the four manufacturers as a result of years of continuous research and superior technical skill. The various types of JBEC bearings being used in all fields of transportation and industry are *the* bearings which will smoothly carry you on to the road of prosperity

NTN
TOYO BEARING MFG. CO., LTD

NACHI
FUJIKOSHI STEEL INDUSTRY CO., LTD.

SKI ASAHI
ASAHI SEIKO CO., LTD

JBEC

JAPAN BEARING EXPORT CO., LTD.
Toranomon Bldg., Minato-ku, Tokyo
Cable Add: "BEARYUSITSU" TOKYO

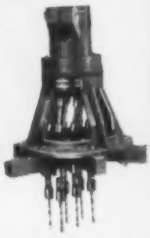
For more data circle Item 707 on Inquiry Card

THRIFTMASTER

your source for dependable

DRILLHEADS

Universal Joint Type Drillhead . . . Full Ball or Bronze Bearing Construction, Standard or Heavy Duty. From ½" minimum centers up. Capacities ½" in Steel.



Gear Driven Eccentric Type Adjustable Drillhead . . . Enclosed, Full Ball Bearing Construction. Double Eccentric Type Adjustable Drillhead illustrated.

Special Fixed Center Drillhead . . . Made to your requirements. Full Ball Bearing Construction.

We stock or can build the right drillhead for your jobs.

Makers of
DORMAN AUTOMATIC REVERSE TAPPERS

THRIFTMASTER Products Corporation
A SUBSIDIARY OF THOMPSON INDUSTRIES, INC.

Write for your free copy of the THRIFTMASTER CATALOG or phone for a rush, on-the-spot quote.

1014 N. Plum Street
Lancaster, Pennsylvania

For more data circle Item 708 on Inquiry Card

GEARS

Made to Your Specifications

You and we can form a team—you to draw up the specifications; we to make the gears—that will be profitable to both of us. Gears of all types, all sizes, all materials. Design-engineering service available.

Custom Gears Exclusively

DIEFENDORF GEAR CORPORATION

Syracuse 1, N. Y.

DIEFENDORF GEARS

For more data cricle Item 710 on Inquiry Card

Heavy Duty
ALLEN PUNCH PRESSES

POWERFUL • DEPENDABLE
ECONOMICAL
FULLY GUARANTEED

Moderate in Price

Hundreds of different Model Combinations 1 to 12 ton Capacities

See your Supply Dealer or write for catalog giving complete information, specifications and prices on our line of Heavy Duty Punch Presses.

Model BT-12
12 Ton—$437.50
less motor—fob

Thousands in use the World over

Model B-2—2 Ton
$87.50
less motor—fob

Model LTX—Special Duty
1 Ton—$80.50 less motor—fob

Model BT-5
5 Ton
$100.50
less motor—fob

ALVA ALLEN INDUSTRIES
Dept. M Clinton, Missouri

For more data circle Item 709 on Inquiry Card

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303R North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2303R NORTH 11TH ST., ST. LOUIS 6, MO.

For more data circle Item 711 on Inquiry Card

JIG AND FIXTURE DESIGN

A practical book with 382 pages of information on the design and construction of jigs and fixtures for drilling, boring, planing and milling. $5 per copy. Sent on approval.

MACHINERY, 93 Worth St., New York 13, N. Y.

BRITISH PRECISION GEARS

ALL TYPES & GEARED ASSEMBLIES FOR-
ELECTRONIC
MISSILE
INSTRUMENT
AIRCRAFT
BUSINESS
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ETC....

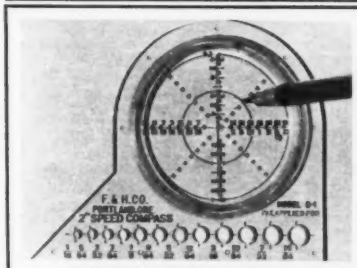
ENCLOSE DRAWINGS FOR KEEN QUOTATIONS BY RETURN

WRITE DIRECT TO:-

THE DAVALL GEAR COMPANY LTD

POTTERS BAR · MIDDLESEX · ENGLAND

For more data circle Item 712 on Inquiry Card



Now, draw circles with a spin of the draftman's pencil in this new SPEED circle template. Smooth ball-bearing action assures effortless drawing. Compact, always ready for use. Insures greater accuracy.

SUCCESSOR TO THE COMPASS

Faster, More Accurate—Versatile

Draftsmens' Model D-1 graduated in 32nds to 2". Model S-1 in 16ths to 2". Postpaid $2.00. Money back guarantee.

F & H Mfg. Co. Room 10, 817 NW 23rd St., Portland 10, Ore.

For more data circle Item 713 on Inquiry Card

None Better than these Lowest Priced POLYETHYLENE THREAD and TUBE PROTECTORS

MITEY-TITES

seal out moisture and dirt—protect end fittings through handling and shipping

For prices and complete list of sizes, write to

A. E. MAYBRUN CO.

920 Ripley Street, Santa Rosa, California

For more data circle Item 714 on Inquiry Card

CAMS

ALL TYPES MADE TO YOUR SPECS!

Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres.

EISLER ENGINEERING CO., INC. | 738 SOUTH 13TH STREET NEWARK 3, N. J. U.S.A.

For more data circle Item 715 on Inquiry Card

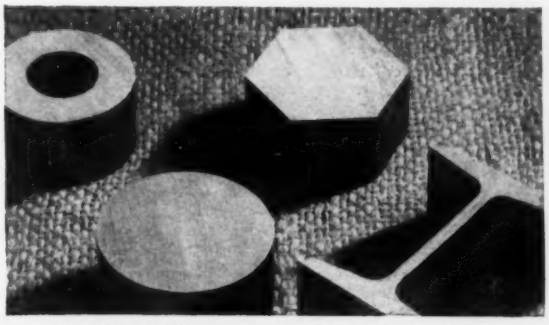
does your ear hear profits . . . or losses?

when you listen to your saws cutting?

If the sounds of cut-off saws are all alike to you, you may be on the wrong wave length for profits.

For today the difference in cutting sounds can mean PROFITS for you.

When you hear the zip of a Wallace Modular streaking through a piece of metal, you're listening to the welcome sound of greater efficiency, slashing your cutting costs. For this machine gives you . . .



Machined-like cuts . . . like those above . . . in seconds each! You get not one, but TWO CLEAN ENDS. Angles, bars, pipes, structurals and special shapes cut with O.K. end finish.

You will want information that will show you how to turn that sound into real profits! Send for your *free* 36-page booklet on Wallace Cut-Machining.

DO IT NOW

WALLACE SUPPLIES MFG. CO.

CUTTING MACHINES • BENDING MACHINES • FLARING MACHINES

1310 W. Diversey Pkwy. • Chicago 14, Illinois

For more data circle Item 716 on Inquiry Card

Classified and Re-Sale Section

eastern Rebuilt Machine Tools

THE SIGN OF QUALITY

THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard— THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS.

PLANERS

P10 Coulter Crank Type Shaper-Planer, m.d., 1 head
30"x30"x8' table G. A. Gray Double Housing, belt drive
30"x30"x10' Cincinnati, belted m.d., 2 heads
36"x36"x8' Cincinnati, m.d., 2 heads on rail
36"x36"x10' Cincinnati Openside, D.C. reversing m.d.
36"x36'x12" Betts, m.d., 3 heads
36"x36"x12' G. A. Gray, 2 heads
36"x36"x18' table Cincinnati Double Housing, m.d.
36"x36"20' Cincinnati, 2 heads, belt
36"x36"x20' G. A. Gray Extra Heavy, belt, 2 heads on rail
36" widened to 42"x36"x20' Cincinnati, m.d., 2 rail heads, 1 side head
48"x48"x12" table Sellers "Power Flow" Double Housing, m.d.
48"x48"x18' Niles-Bement-Pond, 2 heads, belt
48"x48"x28' Cincinnati reversing m.d., 4 heads
56"x42"x14' Cincinnati, belt drive, 2 heads

PRESSES

No. 4 Stevenson O.B.I. Punch Press, direct geared flywheel drive
No. 6 Verdin, Kappes & Verdin Straight Side
No. 6 Toledo Single Geared Open Back Inclinable Punch Press, m.d.
No. H3 Niagara Horn Press, single back gear
No. 50-5-84 Minster Straight Side Double Crank Single Geared Press, belt drive
No. 164½ Toledo Toggle Drawing & Deep Stamping
7½ ton French Oil Mill Machine Co. Straightening, m.d., 1942
100 ton Wood Model 8229 Vertical Hydraulic, 4 col., single action-down
600 ton Niles Horizontal Wheel Press
Type 8750 Hennifin Hydraulic Straightening, m.d.
Model H Cleveland O.B.I. Punch Press, belt drive
No. 3AA Canco (American Can Co.) Open Back Inclinable Punch Press, m.d.

PROFILERS

No. 12B Pratt & Whitney Model 1693, 2 spindle, 1944
No. 12M Morey, 2 spindle M. d., 1943
4 spindle 360° Cincinnati Automatic, m.d., 1944
30" capacity 2 spindle Pratt & Whitney Vertical Miller & Profiler, Model 1482, m.d.

PUNCHES & SHEARS

No. 5 Hilles & Jones Punch & Shear, single end, type "G"
No. 7 Thomas Vertical, latest

RAILROAD MACHINERY

No. 2 Niles-Bement-Pond Axle Lathe, m.d.
No. 3 Niles-Bement-Pond Axle Lathe, center drive type
52" Betts Hydraulic Feed Car Wheel Borer & Facer, belt drive
52" Niles-Bement-Pond Car Whel Lathe, m.d.
90" Niles Balanced Quartering & Crank Pin Turning Machine, latest
90" Niles Journal Turning Locomotive Lathe, including 2 inside journal turrets and 3½" spindle double quartering attach., m.d.
90" Niles Driving Wheel Lathe, m.d., latest
Chambersburg Mounting & Dismounting H.S. Duplex Car Wheel Press
300 ton Chambersburg Car Wheel Press, m.d.

SAWS

No. 4B Robertson Economy, m.d., new
No. 4XB Robertson Economy, m.d., new
No. 32B Cochran Big Saw, m.d., new
Model 102, Type JCAW, Cincinnati Elec. Tool & Abrasive Cut-off, m.d.
Model 401 Cutomatic Abrasive Cut-off, m.d.
U 13 Peerless Universal Type H.S. Metal Saw, m.d.
6x6" Peerless High Duty Hydraulic Standard, m.d.

SHAPERS

6" Pratt & Whitney M1506, Model B Vertical
12" Rockford Universal Hydraulic, flanged, m.d.
12" Hendey Universal Back Geared, m.d.
24" American Standard Pattern Auto-Oiled Plain Shaper, m.d.
24" Rockford Hydraulic, m.d.
32" Morton Draw-Cut, m.d., late
32" Ohio, m.d.
32" Cincinnati, m.d., late
36" Rockford Universal Openside Shaper-Planer, m.d.
38" Morton Punch Cut Shaper, m.d.

SHEET METAL MACHINERY

No. 2 Libert Nibble, 28" throat
No. 3⅝" capacity Gray Sheet Metal Cutter, m.d.
No. 11-8BC Buffalo Armor Plate Bar Cutter, m.d.
Model 1236 Libert High Speed Nibbler Type Shear, m.d.
No. 3 Ryerson Rotary Bevel Shear
Model 4510-D Dreis & Krump "Chicago" Steel Press Brake
No. 5 Hilles & Jones Pyramid Type Bending Roll

SLOTTERS

18" Niles-Bement, s.p.d.
20-24" Pattern Dill, m.d.
22" Betts, m.d.
48" Niles, m.d.

TAPPERS

No. 1 Bakewell, m.d., late
No. 2 Haskins, pneumatic control, type 2 CAP
No. 2 Bakewell, m.d.
No. 3 Haskins pneumatic control, type 3 CAP
No. 3C Haskins, pneumatic control, type 3 CAM, m.d.
3 way Naico Tapper & Drill
No. 10 Model 2100 Warner & Swasey Bench Model m.d.

TURRET LATHES

No. 1 Warner & Swasey "Electric", m.d., bar
No. 1B-25 Acme Saddle Type, m.d.
No. 1L Gisholt Universal, m.d., 1943
No. 2 Cincinnati Acme Full Universal, m.d.
No. 2 Bardons & Oliver Ram Type Electric, m.d.
No. 2L Gisholt, 1943
No. 2A Warner & Swasey, 1946
No. 2H8 Libby, 1942
No. 3 Gisholt, m.d. 1945
No. 3A Warner & Swasey, m.d.
No. 3 Bardons & Oliver Ram Type, flanged m.d.
No. 3L Gisholt, m.d., 1943
No. 3AL Gisholt, with cross sliding turret, 1940
No. 4 Midland Universal Ram Type, m.d.
No. 4 Warner & Swasey Universal Ram Type, m.d.
No. 4 Gisholt, 1943
No. 4A Warner & Swasey Universal Hollow Hexagon, m.d.
No. 4A Warner & Swasey Universal, m.d., chucking, 1939

The above is only a partial listing
WRITE FOR COMPLETE STOCK LISTING

THE EASTERN MACHINERY COMPANY
35 Tennessee Avenue, Cincinnati 29, Ohio • MElrose 1-1241 • Cable Address EMCO

DALE W. WRIGHT

ALL REBUILT MACHINE TOOLS ARE NOT THE SAME

As a sales engineer at Miles for the last 3 years I've had the satisfaction of knowing that the machines I've sold would perform like new because I've seen how they are rebuilt from the base up in our plant.

BALANCER. Model 2E0 Tinius Olsen, 1948
BORER, No. 1212 Excell dbl. end
BORING MILL. 3¾" bar No. 5 Dellance, 1942
BORING MILL. 4" Universal Tri-Way 1000 RPM
BORING MILL. 60" Gisholt vert. PRT
CENTERING MACHINES. Nos. 53 & 56 Sandstrand up to 72" between centers
CHUCKER. 675 New Britain 1940
DRILL No. 20 HO Baker hydr. late
DRILL, HEAVY DUTY. No. 262 Barnes, Swing 26", capacity 2", No. 5 M.T., 1943, G.C.G.
GRINDERS, C'LESS. No. 12 Landis, 1947
GRINDER, CYL. 4" x 12" No. N. Landis, 1943
GRINDERS, UNIV. 14" x 14" Mod. 112 Rivett
GRINDERS, CYL. 20" x 72" Landis, 1943
GRINDER, INT. 72A5 Heald, Univ., Hydr.
GRINDER, INT. No. 74 Heald Hydr., 1941
GRINDER, SURF. 8" x 24" DoAll hydr. 1948
GRINDER, SURF. 20" x 24" No. 25A Heald
GRINDER, SURF. 36" No. 16 Blanchard, 1936
GRINDER, SURFACE. 12" x 16" x 36" Mattison, Mag. chuck and rect., 1942
GRINDER, CUTTER. 30" Ingersoll, 1942
GRINDER, CARBIDE, Nos. 48 and 49 Excello
GRINDER, RADIUS, No. 49 VanNorman, late
GRINDER, TOOL & CUTTER. No. 2 Cincinnati
HOB SHARPENER. Type HRS Barber Colman
KELLER. BL2416 Pratt & Whitney 3 Spdl., 1941
LATHES, ENGINE. 13", 15" & 17" LeBlond
MILLER, AUTO 2-20 Kent Owens, 1942
MILLER, AUTO 36" No. 33 Sundstrand
MILLER HAND. No. 2RV Kent-Owens, 1942
MILLERS. No. 10 & 3 VanNorman Duplex
MILLER, PLAIN. No. 2 Cincinnati HSDT, 1940
MILLER PLAIN. No. 3H K & T MSDT 1943
MILLER VERT. No. 2 Brown & Sharpe HSDT, 1943
MILLER. No. 36 VanNorman, ram type, 1942
MILLING MACHINES, HORIZONTAL, No. 5H Kearney & Trecker, plain with Vert. Hd., 1941
ROUTERS, Type A-1R Onsrud Radial 84", late
SAW. 10" x 10" Racine Hydr., Hack, 1941
SHAPER. 6" P&W vert., also 12"
SHAPER. 16" Rockford hydr. univ. 1943
SLOTTER, 36" Rockford Hydraulic, 1942, excellent
TAPPER No. 10 Warner & Swasey, 1948

OVER 1,000 NEW AND USED MACHINE TOOLS IN STOCK
WRITE FOR LATEST STOCK LIST
MILES MACHINERY COMPANY
2045 EAST GENESEE • SAGINAW, MICH. PL. 2-3105

MACHINE TOOLS

No. 2, 3, 5 WARNER & SWASEY Preselector Turret Lathes, Bar Feed, Chucking.
4' x 9" AMERICAN Hole Wizard Radial.
4" x 18" CINCINNATI Cyl. Grinder, Late Type.
No. 3 CINCINNATI H.S. D.T. Horiz. Mill, NEW 1945. Extra table travel, vert. heads.

FALK MACHINERY CO.
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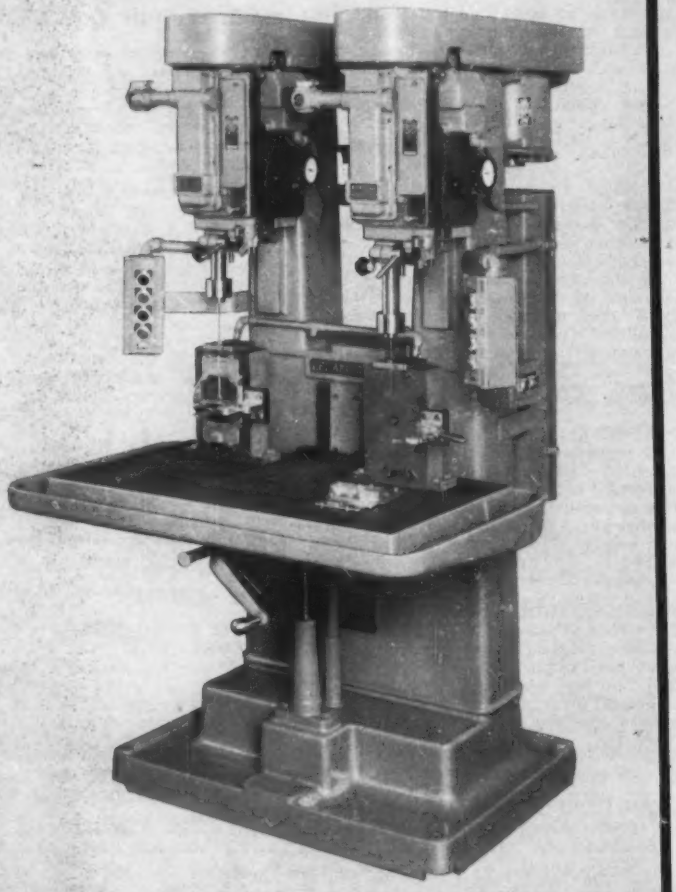

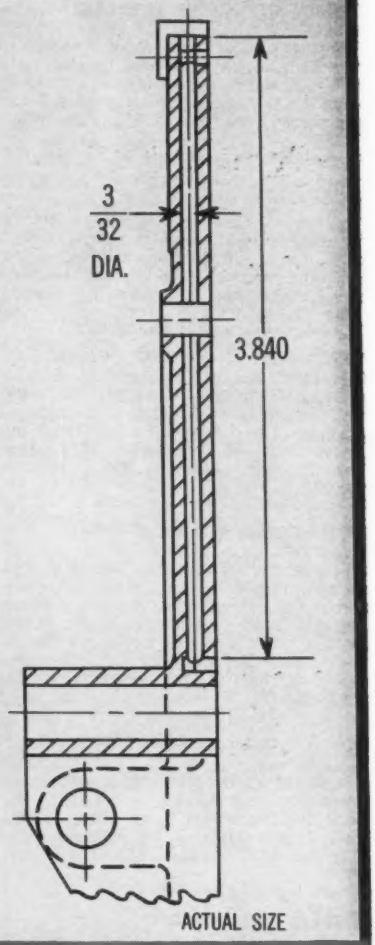

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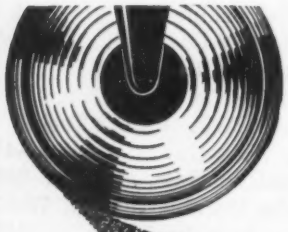

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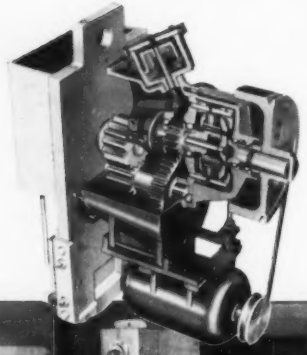

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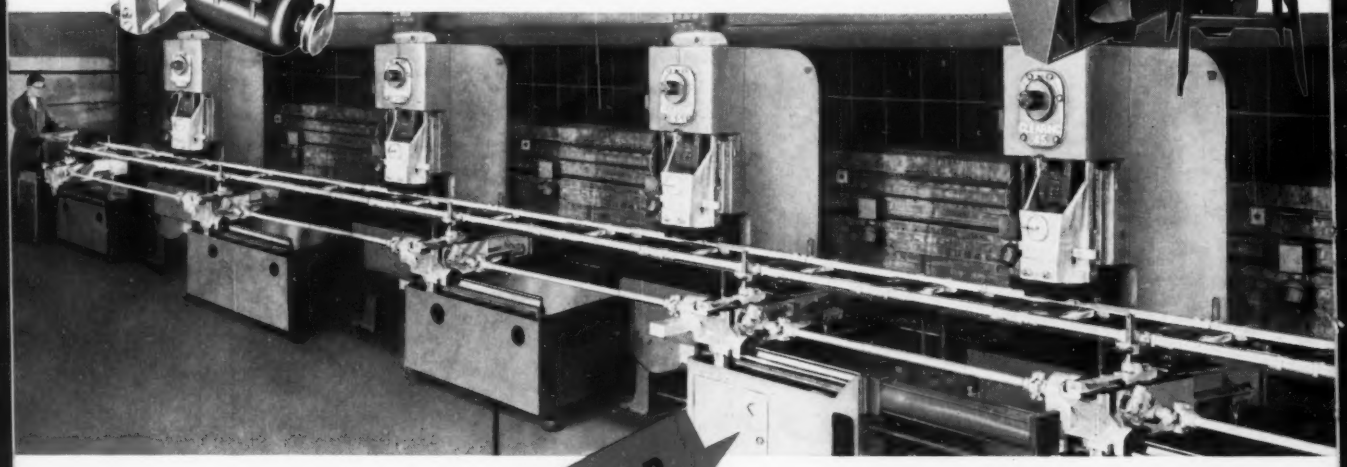

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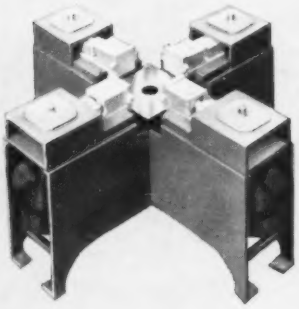

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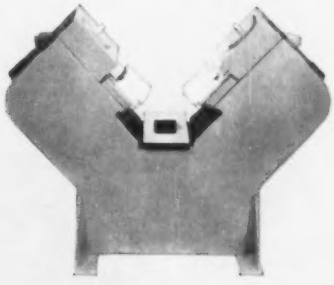

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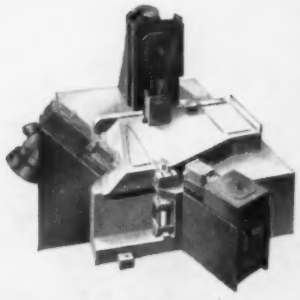

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